# JSAR

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"A free peer-reviewed electronic journal utilising the internet as a medium for the collation and distribution of original, scholarly, yet practitioner focused material on search and rescue."

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# Foreword

**7 October 2014**

On behalf of the Editorial Board, it is my pleasure to welcome you to our third issue of the *Journal of Search and Rescue* (JSAR). JSAR stands to provide a free peer-reviewed electronic journal utilising the internet as a medium for the collation and distribution of scholarly, yet practitioner focused material on search and rescue.

In this issue we have some great peer reviewed articles from the performance of quick release harnesses in swiftwater environments, to the evidential use of GIS in SAR, through to emotional intelligence, coping style, and social support of volunteers involved in SAR. We also have a non-peer reviewed opinion piece on twitter use in SAR, as well as a book review. JSAR continues to grow and we welcome less formal submissions such as these opinion pieces to encourage dialogue and critical evaluation around SAR practice and science.

We are also excited that the University of Canterbury, one of our supporting organisations now offers the world's first graduate qualification named in search and rescue; the *Graduate Certificate in Public Safety (Search & Rescue)* which is available online and those with professional experience can enter this programme without an undergraduate degree. They also have plans to offer a follow on *Masters in Public Safety (Search & Rescue)* from 2016. Both of these programmes will generate a significant amount of scholarly articles which their authors will be encouraged to publish in JSAR. We hope we will see an increase of published volumes with such contributions from next year as a result.

Thanks also to the support from Rescue 3 New Zealand who have sponsored our new look website, which will serve us well into the future. I would like the take the time to thank Daniel Graham who has given considerable time to developing and managing our founding website.  And finally, welcome to Brett Stoffel and Mike Rose who have recently joined our editorial board.

**Steve Glassey**
**Editor-in-Chief**
**Journal of Search & Rescue**
**www.journalofsar.org**

# Contents



** Not peer reviewed.*

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**Cover Image:**

Design courtesy of Robin Blandford, D4H.

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# Improving the performance of swift-water rescue quick release harnesses

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## Abstract

This paper considered the effectiveness of empathic design modifications to quick release harness design. It was found that the critical element in effecting a rapid and efficient release was the tape length distal to the buckle/back-bar components. We have concluded that the length of tape pulled through the buckle and the loading of the buckle/ tri-glide are critical to ensure an effective release. Physical separation of tape and buckle mechanism when the harness is released is crucial to the effective release. We then considered the problems this may pose in multiple user situations such as 'call out' teams or training use and we propose that the adaptation utilised in the research harness to facilitate testing may provide a simple and low cost solution to the multiple user problem allowing easy adjustment of the harness to ensure the separation of buckle and tape on release. We conclude by outlining the design adaptations and recommendations for the training and use of the quick release harness and make recommendations for the training of QRH use.

**Key words:** *Quick Release Harness, swift-water rescue, water rescue,*

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## Introduction

This paper considers the effectiveness of empathic design modifications to the quick release harness used in water rescue. This research firstly outlines the problem, as raised by Onions and Collins (2013). Secondly; outlines and conducts a series of tests on a range of different harness designs and threading configuration and finally will identify features that improve the performance of the quick release harness (QRH). The research discusses the implication for use and concludes by outlining design and technique adaptations to the harness that may address the issues raised.

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## Literature Review

### Problems with Quick release Harness performance

Reflecting the lack of empirical research into QRH performance we have utilised our previous work in this field, c.f. Onions & Collins, (2013). In our previous paper (Onions & Collins 2013) we highlighted inconsistencies in the performance of QRH and concluded that 25% of releases had the potential to or did actually jam and fail to release. In that paper we tested a range of commercially available QRH and interviewed fifteen expert and qualified swift water rescue instructors from the United Kingdom and United States to identify possible reasons for the poor performance. This paper follows directly from that work by testing a series of empathic design adaptations and reflects feedback from that user group.

Three aspects of the QRH performance and its use emerged from the discussions; firstly, the action of the rescuer immediately after the release is activated. Secondly, the interaction of the components in the QRH, and finally; the judgements required in the effective use of the QRH are considered. This paper will focus the first and second considerations; a subsequent paper will explore the broader issues of professional judgment and decision-making in QRH use.

*Current design of PFD and QRH*

Current PFDs consist of pre formed buoyant foam held within a jacket or vest that is worn by the rescuer (Figure 1). A PFD differs from a life jacket, International Standards Organisation, (2006) in that it enables the wearer to swim in a conventional facedown (front-crawl position) and protects the back while swimming defensively (feet downstream, face up) Rescue PFDs have an integral QRH around the outside of the jacket although exact details of design vary between manufactures. This QRH generally contains a 40-50 mm tape that passes around the chest and back at a mid thoracic level.

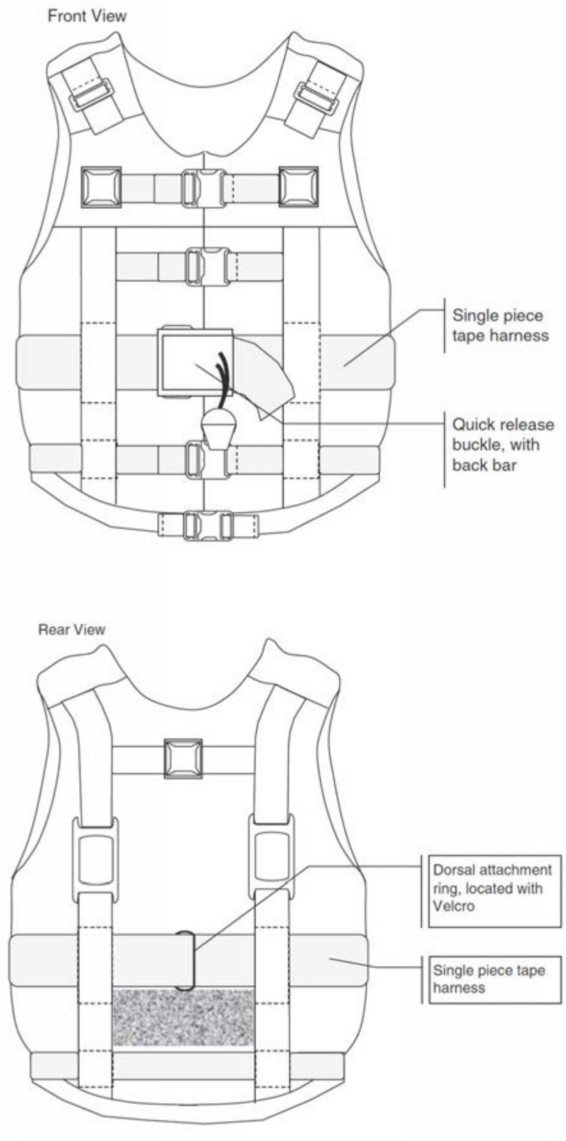


*Figure 1: Front and read view of PFD illustrating position of QRH in current PFD design and components of QRH system. Reproduce with permission from Emerald publishing, Onions, C. & Collins, L. (2013). Performance of quick release harnesses in swiftwater rescue. International Journal of Emergency Services, 2 (2). 141- 154*

This tape has a dorsal attached mid back and a quick release mechanism on the front that can be activated by the wearer and release the tape. The dorsal attachment point on PFDs is mid thoracic spine and differs from the higher (upper thoracic spine) attachment found on working at height, fall arrest harnesses (c.f. International Standards Organisation, 2000).

The release mechanism is a crucial element of the QRH design; it enables the wearers to separate themselves from the tethering line, used during a rescue, in the event of entanglement or an excessive pressure on the wearers' torso the harness can be released and the rescuer either self rescue or be recovered by the down stream safety. The QRH release has to be able to operate in a broad range of conditions and loads; within the load range (250N – 2500N) the system is required firstly; to hold (be secure) and secondly to be able to release in under 10 seconds (International Standards Organisation, 2006; Underwriters laboratory Inc., 2008).

To address the maximum load capabilities (2.5kN) the QRH manufactures include a 'tri glide to the release mechanism that holds the load via a *capstan effect* (Attaway, 1999) with the releasable buckle holding the tape 'locked' to the tri-glide. When the releasable buckle is activated the capstan effect is reduced on the tri-glide and the tape can be pulled from the mechanism by the force of the water on the rescuer. This upper limit may benefit from further research as users anecdotally report spontaneous releases (Onions and Collins, 2013) with some buckling configurations and concerns regarding the judgements required in selecting to utilise the tri-glide under low flow conditions. Equally, concerns regarding the capacity of the rescuers body to withhold the high loads around the chest must also be considered. Bierman, Wilder and Hellems (1946) historical research conducted in the Second World War identified that the compressive forces (similar in range to those described by ISO standard) diminished thoracic respirations (breathing) and effected pulse pressure causing bradycardia (heart function). Both may bring into question the value of 2.5kN upper limit in the standard requirements however the upper limit discussion will fall outside the remit of this paper.

Given the increasing use of this QRH as an adjunct to water rescue in low energy/ force conditions (Ray, 1996, 1998), its potential inclusion in standard operating procedures and its 25% failure rate (Onions and Collins, 2013) in those conditions there is an imperative for investigation and improvement of the harness, its performance and use. Evidence based on empirical investigation will benefit deploying agencies, rescuers, trainers and manufacturers.

This paper will test a range of modifications to the QRH reflecting our initial paper and identify a range of solutions that could be applied in the field. In this respect we will focus consideration on the action of the rescuer immediately after the release and the operation of the harness during the release.

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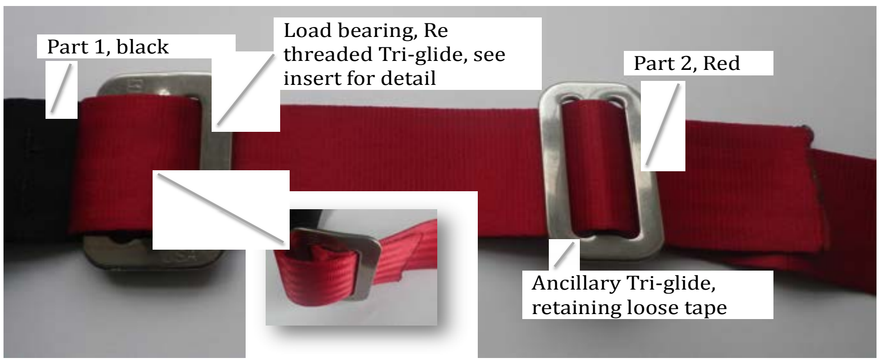
## Method

A single design of personal floatation devises (PFD) was utilised and supplied by a UK manufacturer. The supplied 50 mm QRH was removed from the PFD but no other alteration made to the fabric of the PFD. The PFD was sized and donned in accordance with the manufacturers recommendations and an adapted harness retrofitted. The harnesses under test utilised the same release mechanism as the original harnesses but was threaded in a variety of different configurations, dependant on the test requirements.

## Adaptation to QRH

As stated, the adapted 50 mm QRH functioned in an identical manner to the original harness with two modifications for test purposes. Firstly; the test harness was cut into two parts. The first part; Buckle/ tri glide, 25 cm of tape at this point an adjustable/load bearing buckle was added. A second part was made of a single length (150 cm) of 50 mm webbing. Part two; separate tape which continued from the adjustable load bearing buckle, around the body returning to the quick release mechanism. This tape could be adjusted and threaded to become load bearing at the *new* buckle. (Picture 1).




*Picture 1: Showing load bearing connection of part 1 and 2*

To ensure consistent performance part 2 of the harness was constructed of tape manufactured to consistent quality and behaviour. Random samples were selected from a 100 m reel and prepared as individual lengths of tape to form part two of the harness.

*Part 1 of the QRH*

Part 1 comprised of the cam buckle (A), load bearing tri bar buckle (B). A and B constitutes the quick release mechanism), and the metal three bar buckle (C) to connect to part 2 (as illustrated in picture 1). Part 1 was constructed to a fixed maximum length (25 cm). Two versions, an *active* version; that contained an elastic portion that created 15 cm contraction in the length and a *passive* version without elastication were utilised in this research.

*Part 2 of the QRH*

As stated part 2 constitutes a single piece of tape. One end of the tape was trimmed at a diagonal and heat-sealed flat in line with the manufactures advice. The other was trimmed and heat-sealed at ninety degrees. This ninety degree cut end could be connected to part one via the load bearing buckle (C) allowing the length of part two to be adjusted and then secured. Each individual tape length was visually checked following each use to ensure any damage or excessive wear could be identified and the tape removed from the test if required.

The adapted QRH was fixed to the PFD as illustrated in figure 2.

**Sample Group, Safety and Ethical Considerations.**

Following ethical approval a purposive sample group of six participants was selected on the basis of their qualification and experience. Namely being a qualified swift-water rescue instructor with over five years experience. Following a risk assessment and subsequent briefing, participants were equipped with water rescue boots, dry suit, knife and helmet in addition to the PFD/Harness being tested. A down- stream safety back up was maintained, given the location immediately downstream of a dam outflow no up-stream spotter was deployed (one would be required in other settings and is illustrated in Figure 3).

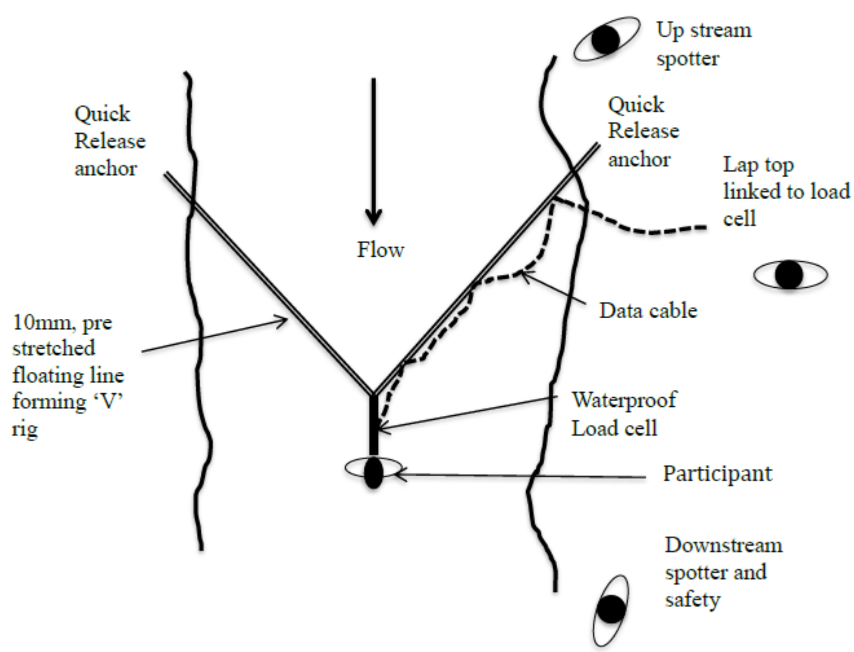



Figure 3: Illustration of V rig utilised in testing

**Procedure**

The participant was positioned mid-stream in the flow by a pre tied V-rig (Figure 3). A waterproof Force Logic™ universal column load cell was connected in series with the dorsal point of attachment of the participant, and the apex of the V-rig. The load cell was connected with a 20 m length of data cable to an in-line signal amplifier. The load cell, cable length and amplifier are calibrated by the manufacturer as a combined unit using a 5-point calibration procedure. A Data Translation™ analogue to digital signal converter was used to transfer the mV signal to a laptop PC and was exported to Microsoft Excel. The manufacturer's calibration curve was used to convert the mV signal to force (N).

A series of ancillary tests was completed to establish the effect of changes in body position on loads in the system, establishing the mean length of tape distal to the release mechanism (the length of tape potentially pulled through the release buckle) and the mean load required to separate the Velcro™ locating attachments on the rear of the PFD. These results are briefly outlined prior to presentation of the results in the following section of the paper.

*Data collection*

A mixed methodology was adopted to generate a rich data source. It was decided not to subject participants to an excessive amount of replicate tests; in preference a broad range of data collection sources was utilised. A sample of 234 releases was performed using a range of different harness configurations.

*Force/ Load data Collection*

The participant adopted a passive floating position in the flow and the participant was instructed to release their chest harness. Force (N) against time (ms) curves was produced in MS Excel using the chart function. The time for complete separation from the harness was determined from the force/time curve profiles.

*Qualitative View of participant*

Following each release the participant was asked to describe the nature of the release using a prompt sheet (Table 1) and any other notes recorded. Participants were encouraged to speculate on reasons for the notable events during the test.

| Rating | Descriptor | Example |
|---|---|---|
| **1** | From release to separation no notable friction or delay in the process | *A smooth consistent and constant flow of the tape through the buckle.* |
| **2** | From release to separation friction and load on the thorax is notable by the participant | *Friction between the tape and buckle is noticeable by feeling rubbing or faltering as the tape pulls through the buckle.* |
| **3** | From release to separation there is a momentary delay in the process that rectified without intervention | *Friction between the tape and buckle is noticeable by feeling the force of water, on the participant, increase as movement in delayed and the tape pulled through the buckle.* |
| **4** | From release to separation there is a momentary stop in the process that is rectified with out intervention from the participant | *The movement of the tape through the buckle is brought to a stop'. Without intervention the stop is rectified and the release continues.* |
| **5** | From release to separation there is a momentary stop in the process that is rectified by an intervention from the participant | *The movement of the tape through the buckle is brought to a stop the participant is required to take a single action to re-establish the movement of the tape through the buckle.* |
| **6** | From release to separation there is a clear stop in the process. That is rectified with repeated intervention from the participant. | *A single intervention from the participant is insufficient to 'free the system' and the repeated actions are required to facilitate movement of the tape through the buckle.* |
| **7** | From release to separation there is a clear stop in the process. That is rectified by intervention from the bank | *Assistance required recover participant to the bank.*<br>*or*<br>*When loaded in the water the system fails.* |

Table 1: Rating scale used to assist participant in quantifying the performance of the harness.

*Direct observation of performance*

Digital video footage of the front of the harness was taken using a Go Pro Hero-2™ helmet mounted camera during a random sample of releases from each test (S=25). This footage was reviewed at 50% of normal speed; this provided direct observation of the QRH in operation.

# Results and Discussion

## Ancillary tests

*Body position test*

The participant was positioned mid flow on the 'V' rig as stated. Once a base line reading was clear the participant was instructed, via an agreed signal from the down stream safety, to alter their profile to the water by extending their arms and legs away from the body into a 'star' shape, this was repeated three times (S= 300) prior to the release test. Following the body position test the harness was released and the participant recovered. During this test a mean load on the harness while the rescuer was passive in the water was recorded (500N, SD 25N). While assuming the 'star shape' a mean load of 725N (SD 25N) on the harness was recorded. Under these conditions this represents an increase of 45% load on the harness by adopting a star shape.

*Average Length of Tape Pulled Through the Buckle/ tri-glide*

The length of tape on QRH (S-75) on recreational white water kayakers and canoeists was measured (S=75, M= 37.8 cm, SD= 17.34). For the purpose of the test this was rounded up to 38 cm and taken as the average length of tape pulled through the buckle in the event of a release.

*Velcro™ release*

At the dorsal point of the PFD the manufacturer utilised a 2 x 4 cm *Velcro*™ patch to locate the connecting metal ring, it was considered that the separation of the *Velcro*™ parts would require a load and that this would contribute to the overall load require to release the harness. The harness and PFD was positioned on a test torso and secured. The harness was then removed leaving the Velcro™ and metal ring in place. A digital load meter was attached to the ring and a load-exerted perpendicular to the *Velcro* patch to determine the load, measured to the nearest whole newton (N) required to separate the male and female Velcro™ components (S=45, M= 43N, SD= 0.83). It was concluded that the mean load required to separate the Velcro™ was relevant and that the maximum loads required equated to the positive buoyancy afforded by the PFD. It therefore follows that the PFD could be held under water by the Velcro™ tab in the worst case. It was concluded to remove the Velcro™ locating patches for the test on the grounds that this was a simple method of improving low load release

**Harness configurations test**

The following five configurations are outlined in table 2. Digital footage of the tests is available at http://youtu.be/ifuLlW0wp9E

Table 2: Test Configurations and results

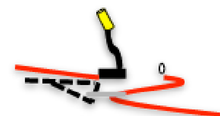
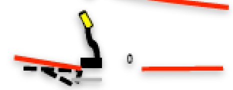
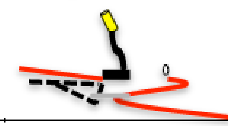
| | Part 1 | Configuration | | | | | Means and S & (SD) | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Tri - bar threaded | Tail Length (cm) | Diagram | PFD threading | Release mechanism | Load (N) | Time (0.1 S) | Rating (1-6) |
| 1 | Passive | Yes | 38 |  | All Loops | Tape | 500 | 12 | 2.13(1.18) |
| 2 | Passive | | | | | | 500 | 11 | 1.7(1.00) |
| 3 | Passive | Yes | 10 |  | | Toggle | 500 | 5 | 1.28(1.01) |
| 4 | Passive | No | |  | | | 500 | 5 | 1 (0) |
| 5 | Active | Yes | |  | Dorsal only | | 500 | 4 | 1.07(0.26) |

Table 2: Test Configurations and results

*Test 1*

The harness was configured as illustrated table 1 the release activated by utilising the tape to open the cam buckle. Direct observation of the release illustrated that during activation the tape forced the buckle and tri-glide against the PFD. The tape remains through the buckle and moves only once the rescuer has released their grip on the tape. This leaves the tape describing a tight ‘Z’ between the buckle and tri-glide and forced against the PFD, clamping the mechanism to the jacket and maintaining the capstan effect in the mechanism until the tape is released.

*Test 2*

The test was repeated using the toggle to activate the release. Direct observation indicated the tape moving immediately on activation of the release. The tape continues to describe an ‘open’ Z as the tape is pulled through the mechanism. This Z created friction between activation and separation however the mechanism was pulled away from PFD and pivoting on the attachment point with the PFD. An increase in performance was noted which was attributed to the reduction of friction and immediate activation noted.

*Test 3*

The harness was configured and released as for test 2 however the length of tape was reduced to 10 cm. An improvement in performance was noted an open ‘Z’ shape was described between the buckle and tri-glide immediately following activation. However it was noted that the action of using the toggle and the short tape length physically separated the tape and buckle at the point of release, however tape was still pulled through the tri-glide (this was the distance between tri-glide and leading edge of the buckle, 3-4 cm).  Notably no tape was pulled through the buckle by the load of the water following release. The load created by the water at the dorsal point was insufficient to withdraw the tape through the tri-glide and around the PFD via the loops and fabric tubes of the PFD.

*Test 4*

The test was repeated without the tri-glide and an improvement in performance was noted, however, occasional spontaneous release where observed during the test. The spontaneous release could not be explained via either direct observation or interview.  The ‘open’ Z described test 2 and 3 was noted, as was the separation of buckle and tape noted in 3. It was considered that the tri-glide needed to be included in threading the harness to enable the higher loads required in the test standards. It was considered that this need not be a problem if separation of the buckle/tri glide and the tape could be assured as noted in test 3.

*Test 5*

Truly zero load conditions are not encountered in any use. The positive floatation of the PFD would always act to provide a load within the mechanism and QRH, this being equivalent to the floatation of the jacket. Examples of low load application include the use of the harness in low-velocity, broad area urban flooding situations where high entanglement potential exists with debris and street furniture and in a swift water context it is also possible to experience deeply re-circulating features/closed features that retain swimmers, but do not possess a water velocity to induce the required load to effect reliable QRH performance. Augmenting the load to ensure separation of tape from tri-glide and buckle in a consistent manner, in minimum time was felt to be a desirable goal. To ensure complete separation (tape from buckle and tri-glide) on the PFDs a shorter length of tape is required. The standards (International Standards Organisation, 2006; Underwriters laboratory Inc., 2008) allow for up to 10 cm slippage in the system, clearly a 5-6 cm length would be impractical and may contribute to spontaneous releases. An elasticated portion was included into the part 1 to ensure a minimum 20 cm of contraction when released. This addition to the QRH assured a separation of the buckle/tri glide and tape without load at the dorsal point. The 'open' Z described test 2 and 3 was noted, as was the separation of buckle/tri-glide and tape noted in 3. Participants commented on the "instantaneous" release but that the tension could be felt around the chest when donning the PFD.

**General Discussion**

An improvement in QRH release performance has been noted. The greatest effect is achieved by ensuring that the length of tape pulled through the buckle, is short enough to ensure a physical separation of part 1 and 2. For consistency, the research utilised a single design of PFD, as a consequence the results cannot be transferred directly to other designs. Namely, the exact length of webbing will be dependent on the detail of the manufactures' PFD construction. Specifically the position at which the QRH is secured at the front of the PFD and the relationship between the length of tape and the arc described by the buckle. This will vary between designs of PFD. A recommendation of a specific webbing length would therefore be inadvisable. However understanding the relationship to achieve better performance would appear critical.

Activation of the release is currently recommended by pulling on the webbing or toggle (Ferrero, 2008). Anecdotal concerns regarding the security of the toggle release have been raised (Onions and Collins 2013). However it is clear from the direct observations that the toggle activated release pulls the buckle/tri-glide away from the PFD, contributing to the physical separation of the components. Webbing activated releases, do not encourage separation of the buckle/tri-glide components and are more prone to problems following activation. These difficulties are compounded should an inexperienced user continue to hold onto the webbing.

The release of the QRH is dependent upon a load (induced by water flow) at the dorsal point of attachment of the PFD wearer. A tensioning system, integral to the harness ensures a load is applied between part 1 and 2 at the buckle/tri-glide mechanism. This tensioning aids physical separation, irrespective of the load at the dorsal point. The release is improved in terms of speed and quality. This adaptation reduces the critically of the tape length distal to the buckle/ tri-glide.

Following separation of buckle/tri-glide and webbing components, the webbing is drawn through a series of loops and fabric tubes that are integral to the design of the PFD. We speculate that in some designs of PFDs these loops and tubes also redirect the webbing and the friction generated clearly places demand on the load at the dorsal point of attachment. Clearly the dorsal locating points are crucial to ensure correct body positioning in the water, however the benefit of additional loops and tubes becomes questionable. Clear benefits can be attributed to threading the PFD in such a manner as to reduce friction by excluding unnecessary redirection. This however may lead to the webbing being higher under the arms of the user depending upon the design of the PFD and the size of the user.

Multiple users of single PFDs in training and rescue situations place sizing and fitting demands on the PFD and QRH. The adaptation made to the harness in this research, enabled the adjustment of tape length at the buckle and has offered a parsimonious solution to the multi user, tape length problem. Namely the integration of an adjustable load bearing buckle connecting part 1 and 2 will enable sizing of the harness on issue prior to use.

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## Conclusion

The most effective releases, in this series of tests, have been achieved by adjusting the tape to ensure physical separation of webbing and buckle/tri-glide mechanism. A simple test while fitting and donning the PFD to activate the QRH release and ensure part 1 and 2 separate would indicate correct sizing and fitting of the harness. Design and manufacture of the PFD will vary, as will the attachment point of the QRH to the PFD. As a result recommendation cannot be made regarding a specific length of webbing. The relationship, however, between the attachment point (PFD to QRH) and tape length being crucial to release. Adjustment of the tape in part 2 and or alteration of the attachment point of part 1 in the relationship $Y+2a<C/4$ to the PFD will contribute to the effectiveness of the release illustrated in Fig 4.

Activation of the release by pulling the toggle away from the body separates the buckle/tri-glide mechanism from the PFD and facilitates the desire separation of webbing and mechanism toggle activation being preferable to webbing activated release that delays and complicates the release. Following release with the toggle, the rescuer should then adopt the ‘star shape’ to expose maximum body surface area to the flow in order to maximise load on the system this pulls the tape from around the PFD. The loops on the rear of the PFD should be used to ensure the attachment point facilitates the correct body position in the water but other loops or tubes need not be used. The tape separates from the PFD following release and reduces friction between PFD and tape.

Adjusting the release mechanism and tape length would enable a consistent use of the load bearing back bar (Tri-Glide) at the release mechanism. In this respect removing the judgement call required when threading the QRH prior to entering the water.

For multi users this trimming of the tape will be impractical and we suggest the desired separation can be achieved by adjusting the webbing via an adjustable load bearing buckle that is positioned between part one and two of the QRH. While we used a doubled back three bar buckle to connect part 1 and 2 other buckle configuration could clearly be used.

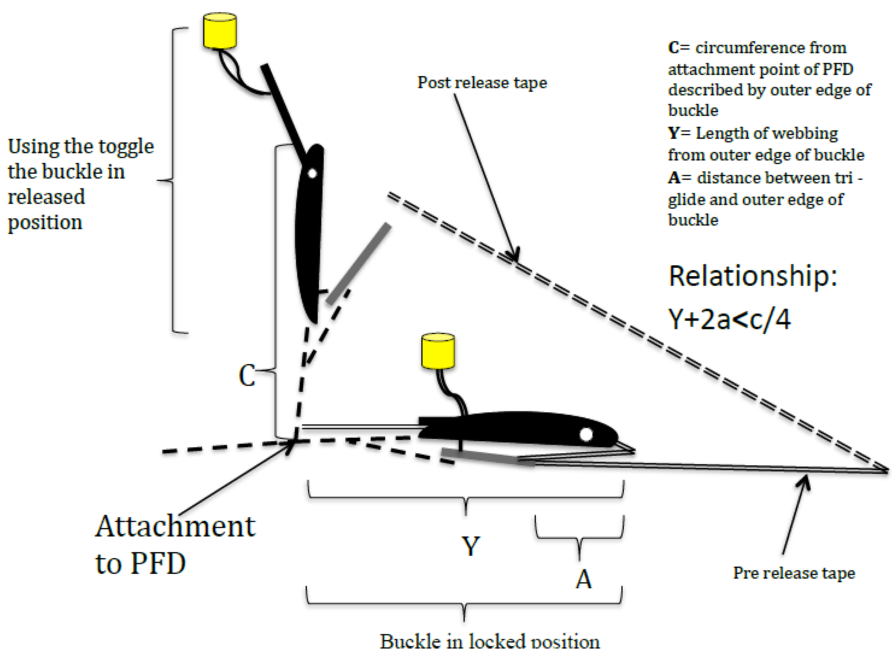


Figure 4: Illustrating the relationship between attachment to PFD and tape length in locked and unlocked positions

Under low flow conditions the pre tension in the harness system, (as outlined) provides an added tension during release and ensures separation of the release mechanism and tape. This would be advantageous in QRH that may be used in both low and high flow conditions. In addition to the conclusions above a reduction in the threading loops and tubes *and* the *Velcro*™ dorsal locating patches should be removed from PFD's, as this appears to be an unnecessary additional force associated with the release of the QRH.

We speculate that further improvements could be achieved by utilising wide radius attachment at the dorsal point, such as the wide end of an HMS type karabiner or large fixed ring. However investigation into the judgements and decision-making that is associated with QRH and swift water rescue may be more valuable in the design of effective rescue technician education programs use is still required and will be subject of our next paper. Based on this evidence we make the following recommendations for training and use of QRH.

- The toggle is used as the primary method to activate the release.
- Following release the rescuer assumes a 'star shape' to maximise load in the system
- QRH is adjusted to ensure that when release a physical separation of part 1 and 2 occur.
- QRH are threaded onto PFDs in such as way as to minimise friction between Tape and PFD following release.

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## Acknowledgements

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## About the Authors

**Loel Collins** has taught swift water rescue for over 30 years. He has taught recreational kayakers and canoeists, Fire service, Royal Society for the Protection of Animals, Ambulance services, Police, Mountain Rescue and the military. He currently works as a Senior Lecturer at the University of Central Lancashire and is a member of the water response capability of the Ogwen valley Mountain Rescue Organisation.

**Chris Onions** is Director of Training with R3 Safety & Rescue Ltd, providing technical rescue training to the emergency services. He is actively involved with the Ogwen Valley Mountain Rescue Organisation and at a regional level with the North Wales Mountain Rescue Association.

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# Evidentiary data collection from Global Positioning Systems: A qualitative study from a Queensland Police Search Coordinator's perspective

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## Abstract

This research focuses on the evidentiary issues of Global Positioning System (GPS) digital data collection in order to achieve consistency both within the Queensland Police Service (QPS) Legislative directives and also in methodical performance with other digital forms in operational and administrative environments. Since digital evidence can be modified, duplicated and/or illegally obtained, the relevance, dependability and admissibility of such evidence needs to be established to achieve court acceptability.

This study investigated QPS policy and the evidentiary requirements of digital procedure within Police Search Coordination. Extensive literature was consulted through academic journal data bases, the QPS Intranet, and relevant websites. This study found a significant absence of GPS data capture techniques, resulting in procedural inconsistencies within the QPS Search Coordination. The study highlighted the topic's relevance, and it is envisaged that consequent recommendations for consistent procedures will minimise occurrences of evidential failure in court situations. Calls for higher standards will require that Search Coordinators understand the transformation of GPS data into admissible evidence.

**Key words:** *Metadata, data, document, global positioning system, evidence, court, computer, standard of proof, statement, admissibility, operational procedures.*

## Introduction

The QPS is the Search and Rescue (SAR) authority in Queensland and is responsible for the overall coordination of SAR operations. Within Queensland, qualified Police Search Coordinators are authorised to organise SAR in land-and marine-based operations. In a SAR case, it is the Search Coordinator who is to bear the "onus" or "burden of proof" of the data evidence and to ensure that the information from the GPS device used is credible and can be evidentially traced (Lynch and Foote

2000). The QPS Search Coordinator is responsible for maintaining and preserving adequate records of the SAR operations (QPS, 2013b).

To date, the Queensland Police Service has collection procedures in place for the taking of digital images, extracting data from computers, and the extraction of video and GPS data from taxi cameras (Morley, 2007). However, the QPS does not have standardised GPS data capture procedures in place for the collection of GPS data with regard to all cases, including Search Coordination. Such procedures are essential to ensure that police integrity is not questioned and that they do not compromise issues (Morley, 2013). The absence of standardized GPS data capture procedures has created procedural inconsistencies within the SAR sphere of the QPS.

There are a number of manuals to which the police refer during SAR operations, including the National Search and Rescue Manual, Australian Land Search Manual, and the QPS Operational Procedures Manual. These documents primarily relate to the SAR procedures that are to be used and they complement each other. Although reasonably detailed, none of these publications consider the need for standardised procedures for the collection of GPS data used in a search.

Little research has been carried out in the specific area of Global Positioning System data collection procedures within Search Coordination. Some researchers have provided explanations for extracting digital data and evidence from computers (Morley, 2013), but this does not take into account the intricacies of tangible GPS data collection procedure. Little consideration has been given to the lack of and inconsistency of evidential procedures (Strawn, 2009; Lynch and Foote, 2000). Within the scope of QPS policy, this specific topic has not been the subject of any previous research and has not, therefore, presented an opportunity for discussion. The absence of instructions for Geographical Information Systems (GIS) for police search coordinators has created data management problems which include the loss, lack of and misplacement of data essential for evidence.

The credibility and reliability of this information and by extension, the decisions based on GIS in a procedural context, necessitate a continuous trail of data to dispel these concerns (Lynch and Foote, 2000). Therefore, instructions are necessary for the efficient functioning of GIS evidence support and evidence clarification, collection and retention. Established procedures standardise GIS data collection methods to improve service to decision makers (Tomaszewski and MacEachren, 2006). It is becoming evident that the use of technology, especially forensic techniques, by law enforcement officers has already resulted in judicial demands for more rigorous science as a criterion for admissibility (Pollack, 2002). Since the QPS has an incomplete and/or inconsistent policy regarding the collection and validity of digital evidence relating to GPS, it risks failing to comply with the minimum requirements for the management of metadata (QGCIO, 2010).

'Evidence' is a term which is defined as 'facts presented for the purpose of deciding a disputed question'. Evidence must be factual and only as such, is allowed to be presented in court matters

(Evidence Act 1977 (QLD) (Austl.). Examples of evidence are a knife used in a stabbing, a written statement taken from a witness by a police officer or GPS tracks and waypoints downloaded from a GPS during a search for a missing person. Courts will admit or exclude evidence sought to be presented based on relevance to a court matter.

The ‘standard of proof’ required in criminal cases in respect of the prosecution is 'beyond a reasonable doubt'. This means that the prosecution must prove its case to the point that there can be no reasonable doubt in the mind of the justice or jury that an offence has occurred. In order for police to successfully pursue a matter in court, it is necessary for them to present incontrovertible evidence to support their case. This standard of proof differs from that required in civil matters where the proof required is the lesser standard of 'on the balance of probabilities’ (QPS, 2013a). The person who brings an action in court is said to bear the "onus of proof". In a SAR case, it is the Search Coordinator who is to bear the “onus” or "burden of proof" of the data evidence and to ensure that information from the GPS is trustworthy and can be evidentially traced (Lynch and Foote, 2000).

Evidence must have legitimacy to help commit a court and jury to a verdict and, as such, information must have relevancy, credibility, trustworthiness, and measurability (Palmer, 2013). A qualitative data analysis of research information collected from Coroners Court findings and legislative literature is evaluated with and against current QPS Operational Procedures. The context of the study is limited to the Queensland Police Search Coordination role and Queensland legislation. The research centres on the question; how can evidence be collected from a GPS and how can it be admissible in a court? This study has two objectives:

(1) To develop understanding of the evidentiary relationship of GPS data;
(2) To explore the legally acceptable and ethical parameters of GPS evidence admissibility in Queensland courts, collection and admissibility of that evidence in Queensland Courts.

### Global Positioning System

To comprehend the evidentiary requirements relating to a GPS, it is necessary to have a basic understanding of the system and how it works. The system was developed by the United States Department of Defence as a tool for the military, primarily for navigation. A GPS uses a series of satellites in orbit around the globe that send out signals to a ground receiver that is then able to use the signals to triangulate a position on or above the earth's surface. The satellite system is supported by a number of ground stations that monitor the data sent by the satellites and transmit corrective data back to them. An identification code for the particular satellite transmitting a data signal is used by the GPS receiver to decipher the position of the receiver in relation to the satellites (Strawn, 2009). As satellites orbit the Earth, they transmit signals to the GPS receiver and the GPS satellite transmits data that indicates its location and the current time. That data can be then transferred to other electronic devices such as a desktop or laptop computer.

## Data

For the purpose of this discussion, data is the information processed or stored by a computer. This information may be in the form of text documents, images, audio clips, software programs, or other types of information. Computer data may be processed by the computer's central processing unit (CPU) and is often stored in files and folders on the computer's hard drive. At its most rudimentary level, computer data is a bunch of ones and zeros, known as binary data. Because all computer data is in binary format, it can be created, processed, saved, and stored digitally. This allows data to be transferred from one computer to another using various network connections and other media. Any collection of information processed by a GPS is data, as a GPS transmits as well as receives signals and stores that information on a hard drive within the GPS (NISO, 2001). For example, a car's satellite navigation system stores the home address and a route to a destination in a GPS device. This can be classified as data.

## Metadata

Metadata is the information that defines and describes data. A computer contains the metadata relating to the data stored within it. An example is a photograph taken on a digital camera and uploaded to a computer. When the image is examined, it may provide information including the date and time when it was taken, the settings used on the camera to take the photograph and even in some cases, where the photograph was taken. This is because some modern cameras have a GPS embedded in them. This information is metadata. Metadata provides information to enable the user to make an informed decision about whether the data is fit for the required purpose. This is the primary difference between an electronic document in its native, electronic form and the same document printed on paper, again with the paper being the metadata (Byrnes, 2009). Metadata may appear alongside the data in the form of geospatial databases and earth imagery, but can also be used to document geospatial resources including data catalogues, mapping applications and data models.

## Document and Statement

A document is defined as, 'in addition to a document in writing, any disc, tape, soundtrack or other device in which sounds or other data (not being visual images) are embodied so as to be capable (with or without the aid of some other equipment) of being reproduced'. A statement is defined in the Act as a document, including any instrument or part of an instrument that purports to have been produced or authenticated at a certain time, in a certain manner, by a certain person (Evidence Act 1977 Schedule 3 (QLD) (Austl.).

## Computer

A computer is defined as a general purpose machine, 'commonly consisting of digital circuitry, that accepts (inputs), stores, manipulates, and generates (outputs) data as numbers, text, graphics, voice, video files, or electrical signals, in accordance with instructions called a program'. Recognised and common devices, such as laptop computers and desktop computers, iPads, smart phones are computers. GPS receivers, such as the Satellite Navigation systems in modern cars, are also classified as computers. Geographical Information Systems (GIS) are an integrated collection of computer software which is used to view and manage data about geographic places. These information systems store data as information that has already been processed and is stored within a computer as metadata (NISO, 2001). The Queensland Evidence Act (Evidence Act (QLD) 1977 s95 (QLD) (Austl.) states that a ‘computer’ means any device for storing and processing information and any reference to information being derived from other information is a reference to its being derived by calculation, comparison or any other process.

### Document Admissibility

In order for documentary evidence to be admissible in civil proceedings, such as Coroners Court matters, the Evidence Act requires that, “in any proceeding (not being a criminal proceeding) where direct oral evidence of a fact would be admissible, any statement contained in a document to establish that fact shall be admissible as evidence if the maker of the statement had personal knowledge of the matters dealt with by the statement, and the document is or forms part of a record relating to any undertaking from information supplied” (Evidence Act s92 1977 (QLD) (Austl.). In criminal proceedings however, in order for documentary evidence as to facts in issue to be admissible, the Act states that, “In any criminal proceeding where direct oral evidence of a fact would be admissible, any statement contained in a document and tending to establish that fact shall, subject to this part, be admissible as evidence of that fact if (a) the document is or forms part of a record (Evidence Act 1977 s93 (QLD) (Austl.).

### Queensland Evidence Act

The Queensland Evidence Act 1977 (Evidence Act 1977 s95 (QLD) (Austl.) establishes that GIS data in a statement shall be evidence if a certificate signed by 'a person occupying a responsible position’ in relation to the operation of the relevant device (a GPS) or the management of the relevant activities (a search co-ordinator) and also require that a person signing a statement, stating that they believe that the data is true and correct to these activities. As an example, an SES Officer, who operates a GPS during a SAR operation, provides a witness statement to police stating that he or she operated that device and downloaded that data onto a specific computer.

### Operational Procedures Manual

Queensland Police Service Operational Procedures Manual (OPM) provides instructions and directions for the day-to-day operation of policing. These procedures are essential to ensure legal consistency and quality in policing services. The OPM also requires a written response for contingencies or solutions for common policing problems and ensures that common problems have the same response each time. In particular, the OPM relates to all SAR matters within the QPS and governs the directions and steps a police officer or a SAR Coordinator must take in order to successfully and efficiently coordinate SAR (QPS, 2013b).

The OPM is issued pursuant to the provisions of the Police Service Administration Act 1990 ‘Commissioners Directions’. The aim of this manual is to provide guidance and instructions in salient aspects of operational policing. To this end QPS staff are to comply with the contents of this Manual so that their duties are ‘discharged lawfully, ethically and efficiently’ (PSA Act 1990 (QLD) Austl.).The OPM outlines general policies and procedures which may be adapted to circumstances as they arise.

### Implications Relating to Data Collection and SAR

The QLD Government Information Website contains the purpose, policy and scope for the management of Metadata (QGCIO, 2010). There are three mandatory principles which directly relate to metadata. The principles are; agencies must use standard metadata schemes; agencies must manage their metadata records; and the participation in the consolidation of metadata across all Queensland Government agencies. These requirements draw on Queensland, Australian and international standards and practices for detailed implementation requirements (QGCIO, 2010).

Activities involving data capture and download must comply with the minimum requirements for the management of metadata (QGCIO, 2010). Responsibility, control and coordination of volunteer rescue organisations in all SAR operations lies with the QPS. It is QPS SAR policy that the SAR Coordinator is responsible, procedurally, to undertake a number of duties. In particular, this person is responsible for the coordination, maintaining and preservation of adequate records of the SAR operations (QPS, 2013b).

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## Findings

The purpose of information security within the QPS is to protect the confidentiality, integrity and availability of Queensland Police Service information. Currently there are no procedures set out in the QPS OPM involving GPS data collection, metadata management and GIS, despite policy in place describing the reasons and need for management of data.

The absence of Instructions for GIS support for police search co-ordinators has created issues with data management. Data within a SAR operation should form a logical compilation that serves the purpose of locating a subject. This data can be backed up and moved from one computer to another, and shared with colleagues. Without a management strategy, data will be become impossible to reorganize and subsequently misplaced. This will lead to inefficiency and loss of credibility when data is required to assist in court proceedings, resulting in doubts about the reliability of information from GIS as evidence. By extension, the reliability of decisions based on GIS and the procedural need to evidentially trace that data could also be questioned (Lynch and Foote, 2000). The use of GIS evidence can be supported by signed witness statements, Justices Act 1886 endorsed, thus avoiding the rejection of GPS data as evidence. SAR Coordinators should ensure that statements are obtained from witnesses in appropriate cases and should be obtained at the earliest practicable opportunity (Justices Act 1886 (Qld) (Austl.).

A search coordinator must understand that a GPS is a computer (Evidence Act 1977 Schedule 3 (QLD) (Austl.). GPS information can be manipulated on a GPS device (Strawn, 2009). Data is processed, stored, received and transmitted within the device and can be altered easily and with less trace than information held on a paper documents such as a statement (Lynch and Foote, 2000). A GPS has a central processing unit which stores files and folders and data can be uploaded to a computer and printed out on paper or transferred to another computer in the form of metadata (QGCIO, 2010). Metadata can be presented as a statement and as a representation of fact and as such, is capable of being reproduced (Evidence Act 1977 (QLD) (Austl.).

## Recommendations

The research project has revealed that the Queensland Police SAR Coordinators require standardised guidelines for data collection procedures, in particular for GPS data. Evidentiary issues related to SAR Coordination improvements are linked more to the credibility, perspective and practicality of the recommendations. Gaps identified can be addressed by incorporating data collection procedures within the Queensland Police Operational Procedures Manual. It is recommended that all activities involving data capture should comply with the minimum requirements for the management of metadata (QGCIO, 2010). A legally acceptable and detailed policy and procedures to capture GPS data as evidence is required to achieve compliance to those principles which directly relate to metadata.

## Conclusion

This study highlighted the relevance and purpose of the research relating to SAR operations and has furthered an understanding of the evidentiary relationship with GPS data. The legally acceptable and ethical parameters of GPS evidential data collection and admissibility of that evidence have been explored. These evidential issues are highly relevant to this research topic as there is a need to minimise risk through improved quality of police methods of collection and evidence presentation. There are currently no procedures in the OPM relating to data collection from GPS devices. Proactive information management practices can be seen as a measure of good corporate governance and risk mitigation, particularly for the 'litigation prone' (Byrnes, 2009).

## About the author

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## Abbreviations

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| CPU | Central Processing Unit |
| GIS | Geographical Information System |
| GPS | Global Positioning System |
| OPM | Operational Procedures Manual |
| PSA | Police Service Administration (Act) |
| QGCIO | Queensland Government Chief Information Office |
| QLD | Queensland |
| QPS | Queensland Police Service |
| SAR | Search and Rescue |
| SES | State Emergency Service |

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# Emotional intelligence, coping style, and social support as predictors of post-traumatic stress disorder

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## Abstract

Psychosocial factors operating during or after traumatic events are among the strongest predictors of post-traumatic stress disorder. Lower emotional intelligence has been linked to a range of mental health problems, but its role in psychological adaptation to trauma is unclear. This study evaluated trait emotional intelligence, coping style and social support as predictors of trauma symptomatology in 144 search and rescue volunteers. Emotional intelligence and social support were not associated with symptoms; the strongest predictor was maladaptive coping ($R^2$ = 0.35). Despite limitations, this study raises questions about the utility of the emotional intelligence construct in predicting post-traumatic stress disorder.

**Key words:** *Emotional intelligence, coping style, social support, trauma, post-traumatic stress disorder*

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## Introduction

A traumatic event has been defined as one where a person responds with intense fear, helplessness or horror to a situation involving the potential or actual death, serious injury or compromised physical integrity of the self or others (Diagnostic and Statistical Manual of Mental Disorders (DSM-IV-TR), American Psychiatric Association (APA), 2000). Research suggests that although most people will experience at least one traumatic event in their life, the psychological impact diminishes over time for the majority, with lifetime prevalence of post-traumatic stress disorder (PTSD) being less than 10%

(Kessler, Sonnega, Bromet, Hughes & Nelson, 1995). A diagnosis of PTSD requires that involuntary re-experiencing, hyperarousal, emotional numbing and avoidance are problematic more than a month after the event, causing clinically significant distress or impaired functioning (APA, 2000).

In addition to the types of situation which the general population may encounter (e.g. natural disasters, interpersonal violence, serious accidents or illness, bereavement), some people are also frequently exposed to traumatic events due to the nature of their work (e.g. military, emergency services, and search and rescue personnel). Whilst early intervention following a traumatic event is helpful for some individuals, others may be adversely affected by this and subsequently report increased PTSD symptoms (Roberts, Kitchiner, Kenardy & Bisson, 2010; 2012). It is therefore recommended that preventative interventions should only be offered where they can be carefully targeted at those most likely to experience difficulties. A greater understanding of the factors enabling some people to cope with trauma more adaptively than others is necessary to facilitate the identification of those for whom intervention may reduce the likelihood of developing PTSD.

Research suggests that although characteristics of the event and individual trauma and psychiatric history are also implicated, some of the strongest predictors of PTSD relate to psychosocial processes operating during and after the event (Brewin, Andrews & Valentine, 2000; Kangas, Henry & Bryant 2005; Lilly, Pole, Best, Metzler & Marmar, 2009). This includes a range of variables such as emotional responses and appraisal thereof, emotional regulation, and social support. Some of these factors appear to be closely linked to emotional intelligence (EI), a relatively new construct concerned with individual differences in the way emotions are identified, understood, used and regulated in the self and others (Salovey & Mayer, 1990).

A range of models of EI exist, which can broadly be categorised into those conceptualising it as an ability, and those regarding it as a trait (Cherniss, 2010). Ability EI is described as a set of cognitive abilities (e.g. the ability to perceive, express and regulate emotion), and is most appropriately assessed with maximal performance measures (e.g. Mayer & Salovey, 1997; Mayer, Salovey & Caruso, 2002). These have parallels with IQ measures of general intelligence, presenting respondents with a series of questions or problems to which there are objectively correct answers. Critics find this problematic, noting the difficulties inherent in determining what might be the 'correct' way to feel in any given situation, and questioning whether experiencing emotion differently from one's peers represents impaired ability (Cherniss, 2010). Performance measures are also frequently substituted with self-report questionnaires requiring respondents to assess their own abilities – thought to be particularly susceptible to inaccuracy where EI is low (e.g. Petrides, 2009).

Trait EI is conceptualised as self-perceived facets of personality relating to emotion and is typically measured by self-report (e.g. Petrides, 2011; Petrides, Pita, & Kokkinaki, 2007). Whilst it is acknowledged that this is an appropriate strategy to assess self-perceptions, it has been noted that like all self-reported information, responses are vulnerable to inaccuracy or misrepresentation (Daus, 2006). Although mixed models exist, including a range of abilities and personality features (e.g. Bar-On, 2006), the resulting construct covers such a broad range of factors that its utility has been questioned (Petrides, 2010). The majority of literature continues to treat ability and trait EI as two distinct concepts (Cherniss, 2010).

Whether conceptualised as an ability or a trait, a relationship between EI and reduced vulnerability to PTSD would be consistent with theoretical perspectives. These link the development and maintenance of difficulties to negative appraisals at the time of the event and subsequently, poor encoding and processing of memories, and avoidant coping responses (e.g. Brewin, Dalgleish & Joseph, 1996; Ehlers & Clark, 2000; Foa & Rothbaum, 1998). It is plausible that appraisals of emotional and physiological responses during the event could be influenced by how well these are identified and understood, affecting the degree of arousal and remaining resources available to encode and process memories.

Coping responses are often defined as the thoughts and behaviours an individual employs to try and manage situations that are perceived as stressful and are believed to be determined, in part, by perceptions of one's own capacity to understand and regulate distress, features of emotional intelligence (Folkman & Moskowitz, 2000; Lazarus & Folkman, 1984). There is evidence to support theoretical links between avoidant or maladaptive coping styles – thought to contribute to the maintenance of PTSD by preventing cognitive change – and lower EI (Gohm, Corser & Dalsky, 2005; Hunt & Evans, 2004; Matthews et al., 2006). This suggests a theoretical link between lower EI and avoidant or maladaptive coping styles.

Theory and research also suggest that lack of social support (being able to draw on social relationships to help cope with and manage situations) is associated with PTSD (Brewin et al., 2000; Ozer et al., 2003). It is thought that positive social interactions facilitate the cognitive and emotional processing required for successful adjustment, and support the development of more positive appraisals of the traumatic event and its consequences (e.g. Robinaugh et al., 2011). Several studies have found a positive relationship between EI and social support (Kwako, Szanton, Saligan & Gill, 2011; Lopes, Salovey, Cote & Beers, 2005; Smith et al., 2012), suggesting yet another mechanism by which EI might influence the psychological impact of trauma. For example, people with higher EI might be more likely to access social support for trauma, thus facilitating emotional processing and adjustment.

Evidence indicates that lower EI, particularly when conceptualised as a trait, is associated with a range of mental health problems (Martins, Ramalho & Morin, 2010; Schutte, Malouff, Thorsteinsson, Bhullar & Rooke, 2007). Taken together with the theoretical links outlined above, it appears that EI may be implicated in coping with trauma. Research focusing on this is nevertheless sparse to date, with only nine published studies empirically exploring the relationship (Smith et al., 2012). Although associations between higher EI and reduced psychological distress following trauma exposure were consistently reported, caution should be exercised in making assumptions based on these studies given they were not always directly comparable. For example, exposure to traumatic events in one's occupational role (Wagner & Martin, 2012) is not the same as the trauma of living with breast cancer (Schmidt & Andrykowski, 2004). The evidence base is also limited by the extent to which potentially confounding factors of coping style and social support are considered. Theory and research suggest a number of mechanisms whereby EI might influence psychological adaptation to trauma. What remains unclear is whether these mechanisms, for example, the connections between EI and coping style or social support, fully account for its association with reduced post-traumatic distress. EI is related to differences in the strategies people employ to cope with stressors (e.g. Folkman & Moskowitz, 2000; Matthews et al., 2006), and differences in coping style may influence the psychological impact of trauma (e.g. Bryant & Harvey, 1995). It is therefore possible that any link between EI and more adaptive adjustment to trauma could be explained, at least in part, by its connection with coping style. Only one study has investigated relationships between EI, coping styles and PTSD symptoms (Hunt & Evans, 2004), finding that lower EI was related to avoidant coping, and only accounted for a small proportion of symptom variance.

Given that theoretical perspectives on coping with every-day and traumatic stressors are quite distinct, it is important to consider the types of trauma investigated. Research considering traumatic life events necessarily combines the effects of a broad range of experiences, and it is not always clear whether these would all fall within the definition of a traumatic event provided in diagnostic criteria (e.g. Hunt & Evans, 2004). For example, research findings based on clearly defined experiences (e.g. breast cancer, Schmidt & Andrykowski, 2004; occupational experiences of firefighters, Wagner & Martin, 2012) are more obviously relevant to identifiable populations.

It is known that some groups of people (e.g. emergency services, search and rescue personnel) are more frequently exposed to traumatic events than the general population, and may be at increased risk of developing PTSD (e.g. Fullerton, Ursano & Wang, 2004; North et al., 2002, Perrin et al., 2007). Expanding the evidence base concerning the role of EI in coping with trauma within these groups could be particularly helpful in increasing the applicability of findings to populations for whom the impact of trauma is potentially more problematic. This could arguably maximise clinical relevance in working towards the development of methods to identify and support those most likely to benefit from interventions.

The present study aims to address these limitations by investigating the relationship between trait EI, coping style and social support in search and rescue workers. The following specific research questions will be addressed:

1. Does trait EI predict PTSD symptomatology?
2. If so, does trait EI predict PTSD symptomatology independently of coping style and social support?

# Method

## Participants and Procedure

Participants were recruited from within Mountain Rescue England and Wales, a national charity whose volunteers search for and recover missing and injured people, often under difficult and dangerous circumstances. A sample of 144 Mountain Rescue volunteers was recruited through the organisation's email distribution lists: 124 were men (86%), and 20 were women (14%). As the majority of Mountain Rescue volunteers are men, this gender balance was representative. All Mountain Rescue volunteers are aged 18 or above with no upper age limit; the mean age was 47.24 (*SD* = 9.90, range 22-73). All 144 participants completed the questionnaires.

Ethical approval for the study was granted by Staffordshire University's Ethics and Peer Review Panel. Participants were recruited via an email containing a link to an internet-based survey (held online at www.qualtrics.com). Participants were asked to provide demographic data, and then presented with information about the nature of a traumatic event before being asked how many they had experienced. They were then asked to think about the most traumatic event they had encountered within their Mountain Rescue role, and information was collected about how long ago it occurred and how distressing they found it at the time (using the SUDS). Participants were not required to state what the most traumatic event was. Participants then completed the IES-R, Brief Cope, ISEL and TEIQue-SF questionnaires before being presented with debriefing information. All responses were anonymous.

Research suggests that events experienced as more distressing at the time are likely to have a greater impact (Ozer et al., 2003), but that symptoms often decline over time (Kessler et al., 1995). It is also possible that repeated exposure to trauma can have a cumulative psychological impact (Breslau, Chilcoat, Kessler & Davis, 1999). Therefore, information was also collected about potential confounds: distress severity, time since event, and lifetime number of traumatic events experienced.

## Measures

*Trait Emotional Intelligence Questionnaire – Short Form (TEIQue-SF; Petrides & Furnham, 2006)*

EI was measured with the TEIQue-SF, a self-report questionnaire with 30 items; responses are rated on a 7-point Likert scale from 1 (Completely Disagree) to 7 (Completely Agree). The TEIQue-SF is designed to give a global score of trait EI, and was derived from the full form TEIQue (Petrides, 2009). Evidence suggests that the TEIQue-SF has construct and incremental validity (e.g. Cooper & Petrides, 2010; Mikoljczak et al., 2006; 2007) and in the present study demonstrated good reliability (Cronbach's alpha = 89.4).

*Brief Cope (Carver, 1997)*

Coping style was assessed with the Brief Cope, a 28 item self-report scale with 14 subscales developed from the full length COPE Inventory (Carver, Scheier, & Weintraub, 1989). This was designed to assess the strategies people typically employ to cope with a specified type of stressor, in this case managing the challenges of working as a Mountain Rescue volunteer. Responses are rated on a 4-point Likert scale from 1 ("I haven't been doing this at all") to 4 ("I've been doing this a lot"). The subscales can be combined to give totals for adaptive coping (e.g. positive reframing, acceptance, emotional support) and maladaptive coping (e.g. denial, substance misuse, and self-blame) (Carver, 1997). Evidence supports the validity of adaptive and maladaptive classifications (e.g. Meyer, 2001; Moore, Biegel & McMahon, 2011), with adequate reliability in the present study (Cronbach's alpha = 78.4 and 86.4 respectively).

*Interpersonal Support Evaluation List (ISEL; Cohen, Memelstein, Kamarck & Hoberman, 1985)*

The ISEL is a 40 item self-report measure of perceived social support, requiring responses to questions such as "There are several people that I trust to help solve my problems" on a 4-point Likert scale from 0 (Definitely False) to 3 (Definitely True). The questionnaire yields a total score and also has 4 subscales: appraisal (perceived availability of someone to talk about problems with), tangible (perceived availability of material assistance), self-esteem (perceived availability of positive comparison to others), and belonging (perceived availability of people to do things with). Reliability is demonstrated by Cronbach's alpha of 94.1 in the present sample, and research offers evidence of construct validity (e.g. Wills & Shinar, 1996).

*Impact of Event Scale – Revised (IES-R; Weiss & Marmar, 1995)*

PTSD symptomatology was assessed with the IES-R, a 22 item self-report scale giving a total score and having 3 subscales of intrusion, avoidance and hyperarousal. This is a development of the original IES (Horowitz, Wilner & Alvarez, 1979) with additional items relating to hyperarousal. Construct validity has been demonstrated (e.g. Creamer, Bell & Failla, 2003), and the measure is reliable in the present sample (Cronbach's alpha = 89.9). The IES-R is not intended for use as a diagnostic instrument and no clinical cut off scores are recommended, although research suggests that thresholds ranging from 22 to 33 may identify clinically significant levels of distress (e.g. Creamer et al., 2003).

*Subjective Units of Distress Scale (SUDS; Wolpe, 1990)*

Distress at the time of the traumatic event was assessed with the SUDS, a single item self-report scale on which an individual indicates a number from 0 (No Disturbance) to 10 (Highest Disturbance). As this was rated retrospectively, often many years after the event, the accuracy of responses may not be wholly reliable and the estimated and subjective nature of the measure is acknowledged.

# Results

Descriptive statistics and correlations between variables of interest are shown in Table 1. Participants reported varied trauma experience with respect to time since most distressing event, subjective distress at the time and lifetime number of events experienced. EI was strongly positively related to social support and weakly but significantly negatively correlated with maladaptive coping, meaning that people with higher EI had more social support and engaged in less maladaptive coping strategies.

*Table 1* Descriptive statistics and Pearson correlations between criterion variable (IES-R scores) and independent variables (time since event, SUDS, number of events, coping styles, perceived social support, and EI)

| | IES-R | TSE | SUDS | No. events | Ad Cope | Mal Cope | ISEL | TEIQue - SF |
|---|---|---|---|---|---|---|---|---|
| Mean (*SD*) | 7.01 (8.57) | 76.77 (87.82) | 5.24 (2.57) | 21.72 (34.46) | 24.71 (7.24) | 14.04 (3.03) | 89.89 (16.92) | 155.07 (22.99) |
| IES-R | 1 | | | | | | | |
| TSE | -0.11 | 1 | | | | | | |
| SUDS | 0.33* | 0.16* | 1 | | | | | |
| No. events | 0.09 | 0.12 | 0.03 | 1 | | | | |
| Ad Cope | 0.58* | 0.01 | 0.21* | 0.16* | 1 | | | |
| Mal Cope | 0.59* | -0.04 | 0.18* | 0.30* | 0.63* | 1 | | |
| ISEL | 0.03 | 0.06 | 0.14* | 0.15* | 0.02 | -0.05 | 1 | |
| TEIQue-SF | -0.11 | 0.11 | 0.13 | 0.16* | -0.02 | -0.14* | 0.69* | 1 |

* $p < 0.05$

*Note:* IES-R, Impact of Event Scale – Revised (Weiss & Marmar, 1995); TSE, Time since event (in months); SUDS, Subjective Units of Distress Scale (Wolpe, 1990); Ad Cope, Adaptive coping scales of Brief Cope, (Carver, 1997); Mal Cope, Maladaptive coping scales of Brief Cope, (Carver, 1997);

ISEL, Interpersonal Support Evaluation List (Cohen, Memelstein, Kamarck & Hoberman, 1985); TEIQue-SF, Trait Emotional Intelligence Questionnaire-Short Form (Petrides & Furnham, 2006).

## Regression analyses

To investigate the relationship between EI, coping style and social support (along with the potentially confounding variables of time since event, number of events, and subjectively rated distress (SUDS)) in predicting trauma symptomatology, initial standard multiple regression analysis was carried out. All potential predictors were included at this stage (see Table 2). The model was significant ($F(7,133) = 18.64$, $p < 0.001$), explaining 50% of the variance in IES-R scores ($R^2$), 47% when adjusted. Coping styles and SUDS were significant predictors of trauma symptomatology, but time since event, number of events, social support and EI were not. Gender and age were not selected as variables in the initial study proposal as it was anticipated that the sample would predominantly be male and were the main focus of interest, and age has often not been found to be a predictor of PTSD. However, to control for these variables they were entered into a preliminary regression but were not significant (gender, p=.119 and age p=.110) and thus were not included in the subsequent regression analyses.

*Table 2* Summary of initial standard multiple regression analysis: Unstandardised and standardised coefficients of time since event, SUDS, number of events, coping styles, perceived social support and EI as predictors of trauma symptomatology (IES-R scores).

| | ***B*** | ***SE B*** | $\beta$ |
|---|---|---|---|
| Constant | -16.46 | 4.86 | |
| Time since Event | -0.01 | 0.01 | -.12 |
| SUDS | 0.73 | 0.22 | .22* |
| Number of Events | -0.02 | 0.02 | -.06 |
| Adaptive Coping | 0.37 | 0.10 | .32* |
| Maladaptive Coping | 1.01 | 0.24 | .36* |
| Social Support | 0.07 | 0.04 | .13 |
| Emotional Intelligence | -0.06 | 0.03 | -.15 |

* $p < .05$

*Note:* $R^2 = .50$; Adjusted $R^2 = .47$

In order to maximise precision of the model, all non-significant predictors of psychological impact were removed except time since event, which was approaching significance ($p = 0.06$). Hierarchical regression was then employed (see Table 3) to explore the predictive power of coping styles, SUDS and time since event in predicting PTSD symptoms. Based on the previous analysis, variables were entered in order of their hypothesised predictive power. The full model was significant ($F(4,136) = 31.24$, $p < 0.001$), explaining 48% of the variance in IES-R scores ($R^2$), 46.4% when adjusted, with all variables being significant predictors, though maladaptive and adaptive coping were the strongest predictors, with maladaptive coping demonstrating the highest scores on the IES-R.

*Table 3* Summary of hierarchical multiple regression analysis: Unstandardised and standardised coefficients of coping styles, SUDS, and time since event as predictors of trauma symptomatology (IES-R scores)

| | ***B*** | ***SE B*** | $\beta$ |
|---|---|---|---|
| Step 1 | | | |
| Constant | -16.58 | 2.77 | |
| Maladaptive Coping | 1.68 | 0.19 | .59*** |
| Step 2 | | | |
| Constant | -18.07 | 2.65 | |
| Maladaptive Coping | 1.07 | 0.24 | .38*** |
| Adaptive Coping | 0.41 | 0.10 | .34*** |
| Step 3 | | | |
| Constant | -19.06 | 2.65 | |
| Maladaptive Coping | 1.00 | 0.23 | .35*** |
| Adaptive Coping | 0.37 | 0.10 | .31*** |
| SUDS | 0.73 | 0.22 | .22** |
| Time since Event | -0.01 | 0.01 | -.14* |

*$p < .05$, ** $p < .01$, *** $p < .001$

*Note:* Step 1 $R^2 = .35$; Step 2 $\Delta R^2 = .07$ ($p < .001$); Step 3 $\Delta R^2 = .06$ ($p < .01$)

Further hierarchical multiple regression analysis was undertaken in order to fully address the specific research questions (of whether trait EI predicts PTSD symptomatology, and if so whether it does so independently of coping style and social support). A fourth step was added to the above model, in which social support and emotional intelligence were entered together. The addition to the model was not significant ( $R^2 = 0.01$; change in $F$ (2,134) = 1.75, $p = 0.18$), confirming that these variables did not explain any significant additional variance and EI did not predict PTSD symptomatology in this sample. As EI was not a significant predictor, the second research question became redundant and was not investigated.

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## Discussion

The findings showed that coping styles were the biggest predictor of PTSD symptoms, followed by distress at the time of the event, and time since event. Whilst adaptive and maladaptive coping styles were both significant predictors, maladaptive coping predicted higher scores on the trauma symptom measure. Trait EI and social support did not predict trauma symptoms. These findings are partly consistent with theory and research linking successful adaptation to trauma with individual differences in coping style (e.g. Bryant & Harvey, 1995; Ehlers & Clark, 2000). It is unclear why adaptive coping was also a predictor of PTSD symptoms, though the overall reported trauma symptomology was low. Perhaps where trauma symptoms are low, coping styles are more variable and include a range of both adaptive and maladaptive styles, and are more problematic where there is greater reliance on maladaptive strategies. Given trauma symptoms were low in this sample, it might also suggest that factors other than coping style were influential, which is supported in the finding that the combined significant predictors accounted for less than 50% of the variance. In this sample, the lifetime number of traumatic events experienced was not related to PTSD symptoms, suggesting no cumulative effect of trauma. Event characteristics (retrospectively rated subjective distress and time since most traumatic event) accounted for only a small proportion of the variance in symptoms, supporting suggestions that psychosocial factors may be the strongest predictors of PTSD symptoms (e.g. Brewin et al., 2000).

This is the first known study investigating trait EI and PTSD symptomatology together, and it is interesting that no relationship was identified. EI within the sample was consistent with population norms (Cooper & Petrides, 2010), but relatively low levels of trauma-related symptoms were reported. It therefore remains plausible that trait EI could have greater influence where PTSD symptoms are more extreme.

The finding that lower perceived social support did not predict psychological distress in this sample is not consistent with the majority of published literature (e.g. Ozer et al., 2003). It is noteworthy that Mountain Rescue volunteers operate in teams and meet regularly for training events, and perceived social support may therefore be less variable in this population than in more diverse samples. There may also be some significance in the shared nature of trauma experiences and their organisational sequelae (e.g. formal team debriefing sessions, and/or informal subsequent discussion among team members), which might compensate for variances in other sources of social support. This may suggest that this way of working is helpful in potentially mitigating the psychological impact of trauma.

It is also unclear whether social factors would be more influential where levels of psychological distress are greater. Although the IES-R is not a diagnostic tool, employing a cut off score of 33 would suggest that 2.8% of this sample experienced clinically significant trauma-related symptoms. In light of evidence suggesting that after a traumatic event 8.1% of men and 20.4% of women go on to develop PTSD (Kessler et al., 1995), this figure is lower than might be expected. Although the majority of research finds elevated PTSD prevalence in emergency services and search and rescue personnel, this is not always the case (Del Ben et al., 2006; Javidi & Yadollahie, 2012). This may be due, in part, to self-selection of resilient individuals and early attrition of recruits who find this type of trauma unmanageably distressing, which would be consistent with this study's finding that cumulative exposure was not associated with elevated PTSD symptoms. These effects might be particularly emphasised in organisations like Mountain Rescue where volunteers are unpaid and financial barriers to leaving are minimised, highlighting the importance of considering sample characteristics. It is also noteworthy that in this study, participants reported considerably greater use of adaptive than maladaptive coping strategies. Given that maladaptive coping did explain, albeit minimally, the largest proportion of symptom variance, the general tendency to use more positive strategies may at least partially account for the low rates of trauma-related problems observed in this sample.

Event characteristics may also affect the degree to which EI and social support are implicated in enabling individuals to cope adaptively. Evidence suggests that there may be a relationship between how directly an event is experienced and PTSD symptoms (e.g. Hoge et al., 2004). Although incidents vary, Mountain Rescue volunteers are likely to be more indirectly involved in the majority of traumatic events, and have time to prepare mentally before arriving at the scene. Perhaps EI and social support are more relevant to coping with the potentially more severe psychological impact of unanticipated events or direct harm.

Findings of this study suggest that individual differences in coping style may be more relevant to psychological adaptation to trauma than EI or social support. Owing to the cross-sectional design causality cannot be inferred, but the importance of coping style is consistent with existing research (e.g. Bryant & Harvey, 1995). This may provide a useful starting point in developing psycho-education and training programmes to maximise the use of particular coping strategies, especially for groups of people who are more likely to experience traumatic situations (e.g. by virtue of their occupation).

### Limitations

Research focusing on groups who experience frequent exposure to traumatic events may maximise clinical relevance, in that findings are more likely to be applicable to populations who are at increased risk of developing PTSD (e.g. Fullerton et al., 2004; Perrin et al., 2007). It would nevertheless have been helpful to include a comparison group to evaluate the effects of potentially population-specific factors such as levels of social support. In the absence of a comparison group it would anyway be difficult to determine the degree to which results might be relevant to the general population, or indeed to other groups frequently exposed to trauma (e.g. firefighters) with different team and support structures.

A further limitation of this research was the constrained range of PTSD symptomatology reported, meaning that the role of EI and social support are unclear where the psychological impact of trauma is more extreme; evidence from clinical samples may be needed to address this question. Although measures were completed anonymously, as with all self-report questionnaires, there is a possibility of socially desirable or inaccurate responses due to poor self-awareness or deliberate misrepresentation. Taken together, these factors may influence both the extent to which distress is recognised, and the openness with which it is reported. Finally, owing to consideration of the response burden on participants, a number of factors thought to predict PTSD were not investigated (e.g. childhood maltreatment and family psychiatric history, Brewin et al., 2000). Given this study found that EI, coping style, social support and event characteristics accounted for less than half the variance in PTSD symptoms, future research including a wider range of variables may therefore generate models with greater explanatory power.

Despite its limitations, however, this study raises questions about the incremental utility of EI, over and above coping style and social support, in predicting PTSD symptomatology. In addition to controversies surrounding its definition and measurement, EI is a relatively broad construct which overlaps substantially with other measures of individual differences associated with adaptive functioning (e.g. Van Rooy & Viswesvaran, 2004).

### Future Research

As characteristics of the sample limit the extent to which results can be generalised, further research is needed to determine whether EI is a useful construct in considering individual differences in psychological adaptation to trauma. An improved understanding of the factors affecting vulnerability to PTSD would offer greater insight into the development and maintenance of PTSD, and could therefore help to refine intervention strategies. It would also facilitate the identification of those most at risk in the aftermath of a traumatic event, which is particularly important in light of evidence suggesting that preventative interventions may actually exacerbate symptoms for some individuals (Roberts et al., 2010; 2012).

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## Conclusion

Neither trait EI nor social support were associated with trauma-related symptoms, the strongest predictor of which was a maladaptive coping style. Trait EI was correlated with social support and coping style, suggesting that conclusions drawn from regression models not considering all three factors may be unreliable. The finding that maladaptive coping was the strongest predictor of trauma symptoms may be useful in designing training programmes for groups of people who are, like Mountain Rescue volunteers, frequently exposed to traumatic situations. Research suggests that coping styles can become more adaptive in response to intervention (e.g. Steinhardt & Dolbier, 2008), and avoidant strategies have particular implications in the development and maintenance of PTSD (Ehlers & Clark, 2000). Interventions prioritising the development of adaptive coping, rather than general EI enhancement, may, therefore, offer the most effective strategy for minimising the psychological effects of trauma. Further research exploring these issues may be helpful in mitigating the impact of PTSD on individuals, families, services and society as a whole.

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## About the authors

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# Letter: The use of twitter as an early warning system for terrestrial search and rescue *

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**Dear Editor,**

Recently I was informed about an automated email alert system, set up for a local Lowland Search and Rescue team. The team carries out searches for lost and missing people in the British countryside, at the request of the police, local government or fire brigade. To put this into context, the team of about 100 volunteers uses dogs and foot teams and has some specialist water and height access ability. The team operates (including supporting neighbouring teams) over an area of roughly 5-8,000 square miles. The team is alerted by a 'hotphone' number, available to police and fire services, which rings the mobile phone numbers of a small group of senior team members, who then assess the type of search required and (assuming they accept the job) stand up the team with whatever specialism is required. The callout and operation management is handled through the software D4H ([D4H] Technologies, 2014), which enables texts and emails to be sent to groups and subgroups within the larger team.

The 'twitter' alert system involved scanning the twitter feed of the local police force, and automatically forwarding any tweet that contained the keyword "missing" in the form of an email to the management team (as above). The intention was that this would give the management team an early warning and allow them to make preparations in a more timely manner than waiting for the full process of a Police Search Liaison Officer (POLSA) to be appointed, for them to get to grips with the situation and then at some later point give the team their first notification.

The use of twitter as an early warning system for the spread of disease (Chew & Eysenbach, 2010), severe weather (Cates et al, 2013), medicine (Williams et al, 2013) and natural hazards (Vieweg et al 2010), (Chatfield et al, 2013) is well established, but this use struck me as being both original and untested.

I did however have some concerns with this method:-

*Firstly*, this was clearly *not* the intended use of the stream by the Police. Although by its nature twitter is in the public domain, I had some concerns about how this could be viewed. There was some risk that the activity may be seen as a form of 'ambulance chasing' or solicitation for 'shouts' (the colloquial term for operational deployment). In the very worst case scenario, there could be attempted moral pressure put upon police forces by SAR teams who have seen these twitter alerts and decided independently that they should be involved.

*Secondly,* I had doubts about the efficacy of the system in this simple form. Even a cursory look at the stream shows that a number of the tweets were not relevant to the team, even though they contained the key word.

With this in mind, I decided that it would be useful to test the effectiveness of twitter as an early warning system in a Lowland SAR context, using a comparison of actual tweets with the keyword to a randomly generated tweet alert system.

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## Method

I decided that the period 1st August 2013 to 31st August 2013 was a reasonable period of time to study and to observe any patterns. During this period research period there were 183 tweets, 80 shouts and 183 randomly generated messages (to match the number of tweets, to give them the same chance of hitting a shout). The randomly generated messages were created in a Microsoft excel spreadsheet.

After identifying matches, the tweets and shouts were interrogated to determine if the tweet related to the shout, and so could be said to be worthwhile in preparing the team. The random messages could only be assessed as to whether they occurred on the same day or not.

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## Results

The randomly generated alerts matched shouts on 25 occasions, coinciding with 30.9% of shouts, which was close to all tweets containing the word "missing" (24 matches, 29.6% of shouts).

However, when the tweets were analysed to see if they were both before the callout and definitely directly related to the subsequent shout, only 5 matched, at 6.2% of the total available jobs.

| | Number | Percentage |
|---|---|---|
| Random alert matches shout | 25 | 30.9% |
| Tweet date matches shout date | 24 | 29.6% |
| Tweet is before and related to shout | 5 | 6.1% |

On ten occasions both the random alert and twitter feed were on the same day as a shout, and two of those occasions could be directly related to a later, actual shout.

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## Conclusions

The randomly generated results were equally likely to match the shout date, with both random alert and tweet matching approximately 30% of the actual shouts, however *only 6% of tweets led to a callout related to that tweet*. There is clearly a methodological issue with only predicting the date (as there is with counting any tweet with the correct search term) as what is really required is some form of prediction that can be shown to be related to actual deployments.

One way of testing this against a random distribution could be to also include a random time and see if that falls within some tolerance (say 2 hours) of a deployment. However, looking at where the deployments have followed connected tweets, it is not necessarily the case that they follow any consistent time pattern, or that this method would be any more realistic. So, there is clearly a flaw in the comparison method, but overall it suits the purpose for some first-glance investigation here.

The real reason that the match of connected tweets to deployments was so low is related to my objection one – in that this is not what the stream is designed or intended for. The reason there is no relationship between the deployment mechanism and the social media stream is that none was ever intended.

This system could work more efficiently with the inclusion of an additional, specific hashtag, to separate general social-media-directed posts from those that relate to upcoming shouts (something like #SAR), but then it is hard to see what purpose that would serve, as there is *already* a mechanism for alerting teams, through the POLSA system.

To rephrase, the only way to make twitter work as an effective alerting system is to change its fundamental purpose to that of an alerting system. Clearly though, an open, publicly viewable alerting system is not ideal, as much of the relevant information is not for public consumption, which means a follow-up phone call or secure communication would be required, which – seeing as this already happens – makes the twitter component redundant.

In conclusion, the real problems with twitter as an early warning system in this context stem from the fact that it is simply not intended for that purpose, and as such will never be fully appropriate.

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# Book Review: A practitioner's study: about rope rescue rigging (Rhodes, 2014) *

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** Not peer reviewed.*

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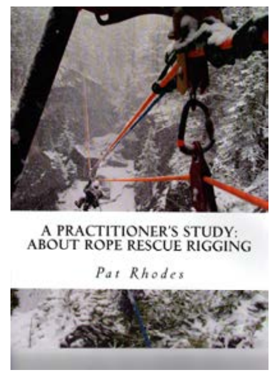
|---|---|
| **Title:** | A practitioner's study: about rope rescue rigging |
| **Author:** | Pat Rhodes |
| **Date:** | April 2014 |
| **Publisher:** | CreateSpace Independent Publishing Platform; First Edition. |
| **ISBN:** | ISBN-10: 1495959813, ISBN-13: 978-1495959813 |
| **Pages:** | 144 (paper back) |
| **Price:** | US$38 (Amazon) |




The title is somewhat misleading as I was expecting a higher level of analysis from a book referring itself to being a study. The book appears to cover topics of interest to the author, rather than a targeted body of knowledge for a certain group or level, as it covers basic knot tying and then is off theorising with physics formula. The content appears to be made up of course handouts and I found the design and layout disappointing when compared with other rope rescue texts on the market such as those by James Frank, Mike Brown and Tom Vines.

In particular there were a number of areas that were not well substantiated or misplaced. Zones were discussed but it appeared to be HAZMAT centric with warm zones typically 50 feet outside the hot zone and not consistent with other teaching ideology (i.e. warm zones being close to the edge and below the drop zone, hot zone being immediately prior and in the high/low angle, and cold zones being well away from either of these. A drawing of a typical high angle incident and the use of zones, rather than for HAZMAT and confined space would have been useful.

The book battles between professional opinion and empirical evidence. Much of the content offered is opinion or preference and although rationale is provided in many cases there is no research cited to validate the claims (though many points I agree with). The use of hand-tied prussiks is apparent (out) and yes, although there are certainly benefits with sewn prussiks (operationally and for the retailers of such product), claims that mis-tied double overhand bends (double fisherman's) as a risk would imply that a rope rescue technician cannot tie what I would deem basic knots (and in such cases, they should not be operational). The pre-disposition for hand-tied prussik loops to side load was also confusing, as when applied correctly (i.e. offset the double overhand knot when connecting), this is not an issue. Just as a RIG descender can be rigged incorrectly, so can a prussic. Incompetence is not a valid reason to discontinue their use.

The use of the Petzl ID is a welcome addition; however the advice given is contradictory to the manufacturer's instruction. Firstly, the belaying position (non-loaded, p67) is incorrect but acknowledged by the author. More concerning however, is that the Petzl I'D (L version) is only rated for heavy load lowering when a second karabiner is used to create additional friction and guide the rope over the lip of the device. All examples of heavy use (i.e. >100kg) in the manufacturers technical sheet specify the use of the second (braking) karabiner and in some cases recommends a Munter (Italian) hitch on the braking karabiner. The book also only uses pictures and illustrations of the Petzl I'D S which is not NFPA General rated. The sole listing of the Petzl I'D S could infer to an unassuming reader that there is only one version or that that the Petzl I'D S is the rescue version creates risks as the Petzl I'D L can operate up to 272kg (72kg more than the Petzl I'D S) under certain rescue conditions (refer Petzl Technical Sheets for further information). This oversight with the Petzl I'D also contradicts the *out* of 1/2" (~12.7mm) rescue rope, and suggests 7/16" rope (~11.11mm) rope is more favourable – yet it is this smaller diameter rope that is not compatible with the Petzl I'D L which carries the NFPA G rating and 36% stronger than its smaller counterpart. This issue is compounded by manufacturers rounding the Imperial and Metric units to suit and that despite having a diameter tolerance to 11.5mm, there are not many 11.5mm rescue ropes available on the market, forcing Petzl I'D L users to adopt 1/2" rope (12.5mm) to ensure compatibility.

Also *out* is the RPM (Rack, Pulley and Mariner's Hitch) which I am in favour of as well, concurring with the experience that it is often too complex and hard to remember for some rope rescue teams (though again, no comparative analysis has been undertaken to provide an empirical basis). However, another area that is *out* according to Rhodes is load releasing hitches, which he says better options are discussed further in his book, however no such methods could be find later on.

The photographs are not always easy to interpret and the primary use of US units of measure and terminology (of knots in particular) limits applicability of the book for a global audience.

In the authors defence, the book does explore a number of contemporary techniques, devices and approaches which will be of use to rope rescue professionals including a well detailed explanation and application of rope physics (the strongest component of the book), building blocks of technical rescue, Petzl RIG, Rapid Ascent and Descent (RAD) rigging, Yate's shorty stitched shock absorber, Kong backup device, and skate-block method. It is these contributions that help evolve the rope rescue discipline and many other areas of needed research is also identified by Rhodes.

Pat Rhodes is a familiar name in the rope rescue world having over 35 years in the industry, 28 of those with the Phoenix Fire Department and 9 years as a FEMA Rescue Specialist. Retired from the

Fire Department, Pat still teaches technical rescue world wide with a private company. As with many of today's veteran technical rescue instructors, Pat appears not to have baccalaureate or graduate qualification, but his publication is edited by his sister Elizabeth who holds a Doctor of Philosophy (Education). Pat does hold an Associate Degree in Arts (Education) and fire related national certifications. The author certainly has credibility in this field, but unfortunately the quality and content of the book does not reflect this.

The book may be of use for instructors who want a chapter on rope physics and to see other gems that Rhodes includes, but it may not be a suitable as a class reference (acknowledging that Rhodes disclaims his book is intended to cover everything). That said, well done to any rope rescue instructor who puts the time into such an effort and publishes their thoughts to improve safety practices and techniques in this field.

## About the reviewer

**Steve Glassey** is the Director of Public Safety Studies at the University of Canterbury, New Zealand. In his previous role as an Emergency Management (USAR) Advisor for the Ministry of Civil Defence & Emergency Management he authored the *National USAR Best Practice Guideline: Rope Rescue Tier Model* and National Certificates in Specialist Rescue (Rope Technician and Rope Instructor). He is a former Technician (CATII) with New Zealand Task Force 1 and Ambulance Rescue Technician/Duty Squad Leader and holds a Masters in Emergency Management. He is an active Instructor Trainer with Rescue 3 International and teaches NFPA1670 and 1006 compliant rope and water technical rescue programmes internationally. In 2014, he along with Geoff Bray (NZ Police Dive Squad) became the first New Zealanders to be awarded the *Higgins & Langley Memorial Award* for their development of the Swiftwater (body) Recovery Specialist (SRS) programme.

# Editorial Board

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