

DO TECHNICAL DIVERS DIE?

A Risk-Based Perspective on Diver Incidents and Fatalities

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1. Introduction

1.1 There seems to be a common misconception that incidents during technical diving lead to death. This is not entirely accurate; while fatalities do occur, not all incidents are fatal. However, with technical diving comes higher risks.

1.2 After attending an evening seminar about diving with the emphasis on Hyperbaric Medicine in Malta & Gozo and Tips for Diving Incidents, by Dr Kurt Magri Gatt, one of the participants was of the opinion, that technical divers when involved in incidents die (perhaps more often due to a higher risk). I realized that there might be some confusion as to risks involved when diving, mortality and non-mortality as well as what kind of diving involved. This piqued my curiosity to search for information supporting my thesis that recreational diving was far safer than many divers may assume.

1.3 As I started my research, I found myself writing far more than I had anticipated. This article is primarily the result of my own interest but if someone else finds it useful the better it is.

1.4 I am not a scientist or a researcher so my addition to the topic at hand is non-academic and based on my own findings and experience as a PADI Staff instructor as well as a Hollis Prism2 rebreather instructor and a technician on various brands. I will refer to sources for the reader to pursue any part of this article in his or her own interest.

1.5 As a final remark I will make this paper dynamic. The more I read and the more I understand, I will refine the information in this paper and hopefully – one day – it will, if nothing else, serve as a good source reference.

2. What is the difference between recreational and technical diving?

2.1 To understand statistics, it's important to understand the differences between recreational and technical diving.

Recreational diving

2.2 PADI and I dare say most of the other agencies defines recreational scuba diving as no-stop (no decompression) diving with air or enriched air to a maximum depth of 18 meters for divers 15 years or older. If you are certified as a PADI Advanced Open Water Diver, you may dive down to 30 meters. Finally, if you are a PADI certified Deep Diver you may dive down to 40 meters and still be within no-decompression limits.

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2.3 Although recreational diving for the most part encompasses open circuit scuba, recreational rebreather diving has gained popularity in recent years. Mind you, even when engaging in recreational diving the foregoing limitations mentioned above still apply.

Technical diving

2.4 Technical diving including open circuit technical diving (Tech OC) as well as closed circuit rebreather diving (CCR diving) are both much about using your brain – thought, discipline and concentration – as physical performance. This kind of diving requires more planning for instance depth, gas and equipment. Technical diving, per definition, takes the diver deeper than 40 meters and thus requires greater gas reserves and different breathing gas mixtures compared to pure air. Often one or more extra tanks are required (stage and/or bailout tanks). Decompression in contrast to safety stops, is a normal feature when it comes to technical diving. Overall things become more complex with technical diving compared to recreational scuba diving. Technical divers accept that with this kind of diving comes greater risks for errors.

2.5 However technical diving is often divided into different sectors, each of which carries different requirements and risks. For the purpose of this article, I decided to divide the different kinds of technical diving. I do not distinguish between backpack and sidemount diving nor between back mounted counter lungs or front mounted counter lungs.

2.6 Furthermore, there is another group of divers or rather statistics of older date and maybe therefore, given the evolution for diving knowledge, equipment development as well as deeper medical and general understanding of diving, of less importance but yet good for comparison.

2.7 While specific statistics on technical diving fatalities are less readily available, it's acknowledged that technical diving carries higher risks due to factors like deeper depths, use of mixed gases, and more complex equipment. However, across both recreational and technical diving, common causes of fatalities include insufficient gas supply, entrapment, equipment problems, and emergency ascents.²

My own thoughts about rebreathers

2.8 I began my CCR journey in 2021, at an age of 60. While I may no longer be a “spring chicken”, I certainly fit the CCR profile older and financially able. However, I am in good physical shape and exercise 3-4 times a week if I can and at this very moment a lot of it consists of swimming. Many seasoning divers, gain weight, but I manage my weight closely in order to stay fit. However, overweight divers are clearly at risk, but so is anyone else who is overweight, regardless of diving level. John Clarke once wrote:

“Rebreather diving is very much like flying a small airplane. It's highly enjoyable, highly technical, and quite useful; but also expensive, and in certain circumstances, lethal.”³

² Divers Alert Network, *Annual report 2020 Edition: A report on 2018 Diving Fatalities, Injuries and Incidents*, and British Sub-Aqua Club, *Annual Diving Incident Report 2023*. **Author's interpretation.**

³ John Clarke, “The Case for an Independent Investigation & Testing Laboratory”, *InDepth Magazine*, October 29, 2019. <https://indepthmag.com/the-case-for-an-independent-investigation-testing-laboratory/>

2.9 I understand his thoughts and since it was published in InDepth, focusing on technical diving rather than recreational diving it makes sense. In certain circumstances it might be lethal. However an increasing numbers of CCR divers are not diving technical dives as defined in the beginning of this article. They stay within no decompression limits and do not go deeper than 30 or 40 (as advanced rebreather divers) meters and mostly stay within 15-20 meters (as rebreather divers). Why than use a CCR for such “shallow” dives one might ask? After all a brand new Hollis Prism2 rebreather for instance, cost in its standard configuration, somewhere around 9 000 Euro. It is a lot of money for anyone.

2.10 There are many reasons diving with a rebreather if you can afford it, and particulalry for *recreational* rebreather diving. Some of the advantages are:

- It is silent and therefore your encounter with marine life is more enjoyable – you don’t scare the fish away, so to speak.
- The gas you breathe is recycled and gas supply becomes a far lesser concern.
- The gas you breathe is moist and warmer and overall more comfortable.
- With a rebreather you always dive with the optimal oxygen mix regardless of depth and you can also change the oxygen by using different setpoints via your handset (controller) in modern technical rebreathers like the Hollis Prism 2.
- You do not wear any weights on you. If you need weights they are attached to your backplate or on your tanks depending on trim and other preferences.
- With recreational rebreather diving you do not have to consider neither gas mixes nor carrying more than one bailout tank and often settle for a 40 cuf tank (easy to carry).
- Due to the construction of a rebreather it is easy to carry. When I travel with the Prism2 I just put as it is without the instruments (and no tanks of course) including the first stages, the loop and DSV, with some paddings in my suitcase. It never exceeds 21 kg.

2.11 There are many brands of rebreathers to choose between, and more are constantly hitting the market. However, the risks that comes with technical diving and especially with CCR are not as striking when it comes to recreational rebreather diving. Yes, the complexity of the CCR itself might still be there, as is the importance of knowing skills like gas sharing, how to mitigate high or low O₂ in the loop etc.⁴ However you only need one bailout tank and seldom have to consider gas mixes, ordinary airfill in your bailout is normally sufficient as is air in your diluent although nitrox is not a bad thing. Since its all about recreational diving it is by it self less stressful and less strenuous for the diver. This latter observation is even more important when getting older and mitigates the medical risks as well.

⁴ *Hollis, Prims2 User Manual*, version HO.04.05.0014, p. 4. Mmanufacturers like Hollis, explicit emphasis the importance of training, following operating checklists and highlight the safety expectations. In Hollis manual, it is written among others: “Risks against which the units are intended to protect the user include the following: 1. A loss of the supply of breathing gas – gas contents monitoring, 2. Injurious levels of oxygen - properly maintained selected PO₂, 3. Injurious levels of CO₂ in the breathing gas - removal of CO₂ from the breathing gas, 4. Unable to return to the surface - buoyancy control and surface flotation” and “No person should breathe from, or attempt to operate in any way, a Hollis PRISM 2 rebreather, or any component part thereof, without first completing an appropriate Hollis Certified usertraining course.” With the proper training and when fully complying with the manual, the risks diving with CCR in general (not cave diving though due to the combination of task loading and environmental risks) are not as striking as one might be led to believe, compared to diving open circuit, especially when it comes to recreational rebreather diving. In the PADI Tec40 CCR manual, Product No. 70997 (11/11) Version 1.0 (2011). P. 277, it is written “Accident data show that one of the most common preventable causes of tec diving accidents in general, and tec CCR dives in particular, is cutting corners.” Human error seems to be a very importan factor. As long as the diver do not “cut corners” the risks involved with CCR diving should be less and even more so when it comes to recreational diving.

3. Composite Risk Index (CRI) Methodology – Diving Risk Assessment and scoring risks in diving (0-10)

3.1 To rank the risks for the different types of divers and diving I have used a version of Composite Risk Index (CRI). Below I will outline the methodology behind the Composite Risk Index (CRI). My version is thus used to evaluate and compare diving risk across various disciplines of diving.

3.2 It contextualizes the approach relative to accepted frameworks in diving safety, engineering risk management, and operational safety. The risk score chart has been formalized in Table 1 below.

Fatality Rate (0–10)	Human Error (0–10)	Complexity (0–10)	Environmental (0–10)	Medical (0–10)
How often fatalities occur per 100,000 participants. 0-0.2 >1 0.2-0.5 >2 0.5-1.0 >3 1-2 >5 2-4 >6 4-6 >7 6-8 > 8 8+ > 9-10	Likelihood that diver behavior (not equipment) causes fatal mistakes: ⁵ 0-2 Minimal (guided DSD) 3-5 Moderate skill demands 6-8 Error-prone procedures 9-10 Extreme task loading	How difficult the gear is to assemble, maintain, and use: 0-2 Snorkel/basic OC 3-5 Basic scuba 6-8 Adv. OC with stage tanks 9-10 CCR/hybrids	Inherent hazards of the dive setting: 0-2 Pool/shallow reef 3-5 Wrecks/deep/open 6-8 Cold/current/overhead 9-10 Caves/mixed gas	How prone the diver population is to non-diving health issues (e.g. cardiac, stroke): 0-2 Fit, screened youth 3-5 Middle-aged, unknown health 6-8 Aging or unfit 9-10 Known conditions or prior issues unknown screening)
Examples: Recreational ~0.18 = Score 1 Rebreathers 2-4 = Score 6 OC Tech Score 5	Examples: Recreational Score 3 Rebreathers Score 8 OC Tech Score 6 Cave Score 9	Examples: Recreational OC Score 2 Rebreathers Score 9 OC Tech Score 7 Cave Score 7	Examples: Recreational Score 2 Rebreathers Score 6 OC Tech Score 4 Cave Score 10	Examples: Recreational Score 6 (27% med-related deaths per Gen Re report). Rebreathers Score 8 (older, affluent demographic). OC Tech Score 5 (some overlap with CCR divers) Cave Score 3 (younger, physically fit). Early Tech Score 4 (less data, but high exertion with unknown screening). Personal note: With age comes a higher medical risk. However those risks are mitigated by the recreational diving itself and the lack of stressfactors like lack of air. The negative side should therefore lay more on the complexity of handling a rebreather.

Table 1

⁵ For instance a recreational diver performing buddy checks is not very difficult nr task loading and would therefore less risky and would yield a score of 3, whereas a CCR diver performing a PPO2 calibration, loop test and pre-dive test would have far more to do and thus increase the taskloading and risk yielding a score of 8.

3.3 The CRI scores led to the result as shown below in Figure 1.

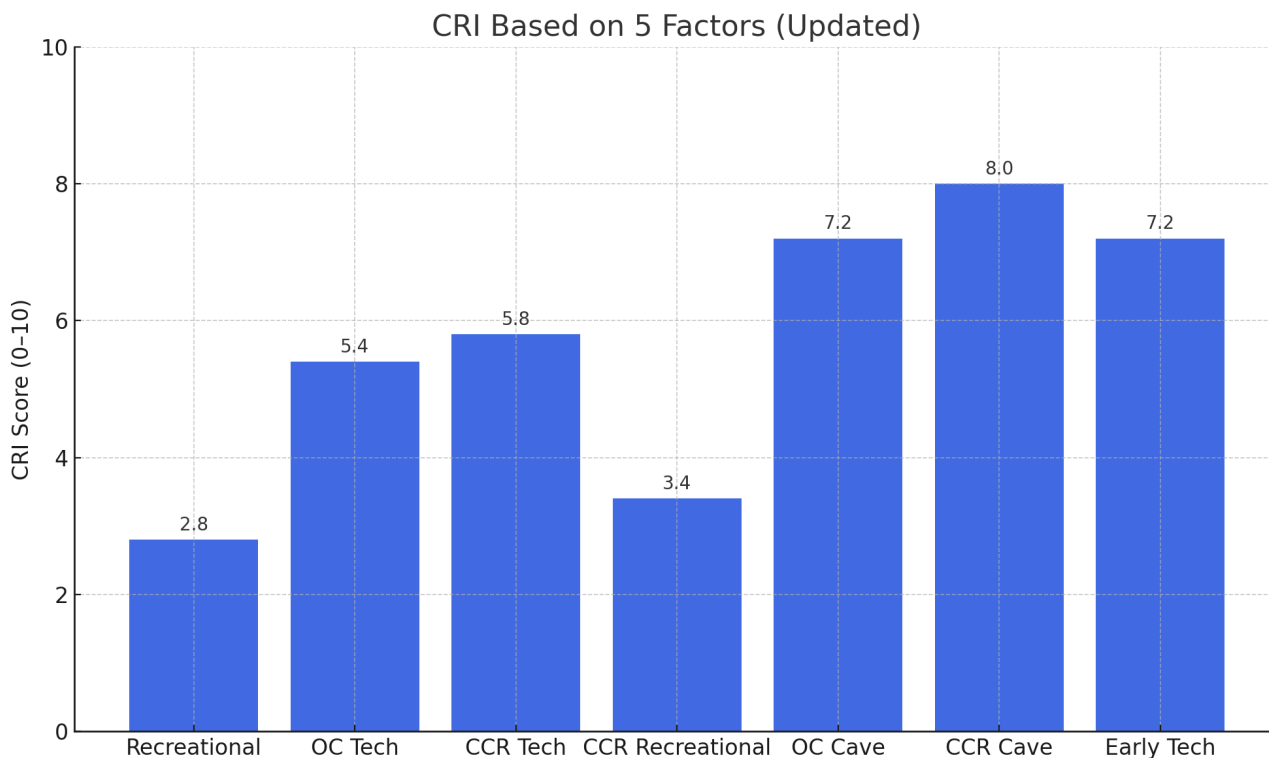


Figure 1

4. What Is a Composite Risk Index (CRI)?

4.1 A Composite Risk Index is a numerical score derived from averaging multiple contributing factors to risk. In the context of diving, the CRI helps visualize how different dive types compare in terms of inherent and preventable risks. This CRI is calculated as the average of five dimensions:

1. Fatality Rate
2. Human Error Risk
3. Equipment Complexity
4. Environmental Hazard, and
5. Medical Risk

The formula⁶

$$\text{CRI} = (\text{Fatality Score} + \text{Human Error Score} + \text{Equipment Score} + \text{Environmental Score} + \text{Medical Risk Score}) / 5$$

Is this method (CRI) used elsewhere?

4.2 While organizations like DAN, BSAC, and NOAA don't use the term "CRI", as far as I have been able to find out, they apply **multi-factor** analyses that consider many of the same variables. The CRI

⁶ The factor 5 is used since the formula is based on averaging across five dimensions.

format used here is consistent with risk matrices in aviation, diving medicine, engineering (HAZOP)⁷, and military frameworks. The method seems to be the normal standard in composite indices used in risk analysis, quality scoring and multifactor evaluations. Examples of this are:

1. Composite health risk scores (blood pressure, cholesterol, etc.)
2. Education indices (literacy+enrolment+teacher ratio)
3. Human development index (HDI).⁸

Why this CRI?

4.3 To understand the risks and visualize them, I needed something to achieve this. CRI provides a structured and transparent method to understand risk distribution across diver types. By combining empirical data (e.g., DAN fatality rates) with some kind of structured judgment, it enables a somewhat comparative insight.

Credibility and Limitations

4.4 This CRI is grounded in, as far as I can tell and despite not identical, like well-established risk analysis practices. It does not constitute a peer-reviewed or statistically certified standard. To clarify it is a composite evaluation based on known risk frameworks. When choosing a scoring number, I have based it on my own experience and from the sources I have found. I do acknowledge however, it is not perfect or entirely objective. Another fact that is not accounted for is the different environment. Diving in warm water like the ones in Thailand is definitely not the same as diving in cold murky waters of the North Sea or the Baltic Sea. Nor is the CRI distinguishing between different medical causes of a diving incident. This meaning for instance drowning-accidents where medical issues are the direct or indirect cause of the outcome does not specifically account for IPO (Immersion Pulmonary Oedema).⁹ As laid out initially, this paper is dynamic and will likely include more details in future versions.

5. Recreational Diving Medical Risk

5.1 Following further analysis by Dr. Åsa Beijer¹⁰ of the Gen Re Business School (“Gen Re”), Edition 2/2015 /DAN report the Medical Risk score for Recreational Diving has been revised from initial 4 to 6. This adjustment reflects the fact that non-diving medical issues were the leading cause of fatalities in 27.1 % of 140 recreational diving incidents. This updated score raises the Recreational CRI from 2.4 to 2.8, aligning it better with observed incident causes. Based on the study, I am of the opinion that the major cause of diving incidents is medical. The results from the study are shown in figure 2 below.

⁷ U.S. Department of Energy, *DOE Handbook Integration of Hazard Analyses (HAZOP)*, version DOE-HDBK-1163-2020, October 2020. The purpose of the handbook is (p. 1) to provide “... facility managers with a comprehensive understanding of the process for identifying and evaluating facility hazards.” In other words HAZOP provides a technique for identifying potential hazards in a system and identifying operability problems.

⁸ Original HDI = $\frac{1}{3}(\text{Life Expectancy}) + \frac{1}{3}(\text{Education}) + \frac{1}{3}(\text{Per-Capita Income})$ Source: University of Victoria, Canada. See <https://web.uvic.ca/~kumara/econ329/HDRCH2.pdf>.

⁹ When we are immersed in water, the hydrostatic pressure causes compression of leg veins. As a result, blood that normally pools in the legs is pushed centrally into the chest. The increased central blood volume increases the pressure in the alveolar capillaries and may cause fluid to leak into the lungs and cause difficulty breathing and if not corrected can cause death. (Diver Guidance for Immersion Pulmonary Oedema (IPO); <https://www.bsac.com/safety/diver-guidance-for-immersion-pulmonary-oedema-ipo/?&&type=rfst&set=true#cookie-widget>).

¹⁰ Åsa Beijer, “*Scuba Diving – What Are the Risks?*” *Gen Re Business School*, Edition 2/2015.

<https://www.genre.com/content/dam/generalreinsuranceprogram/documents/uwfocus15-2-beijer-en.pdf>

5.2 The data from the 140 fatal diving accidents were analyzed by Brian Cumming, Clare Peddie and Jim Watson and their findings were published by the British Sub-Aqua-Club (“BSAC”) as a “review of the nature of diving in the United Kingdom and of diving fatalities in the period 1 st Jan 1998 to 31 st Dec 2009.”¹¹

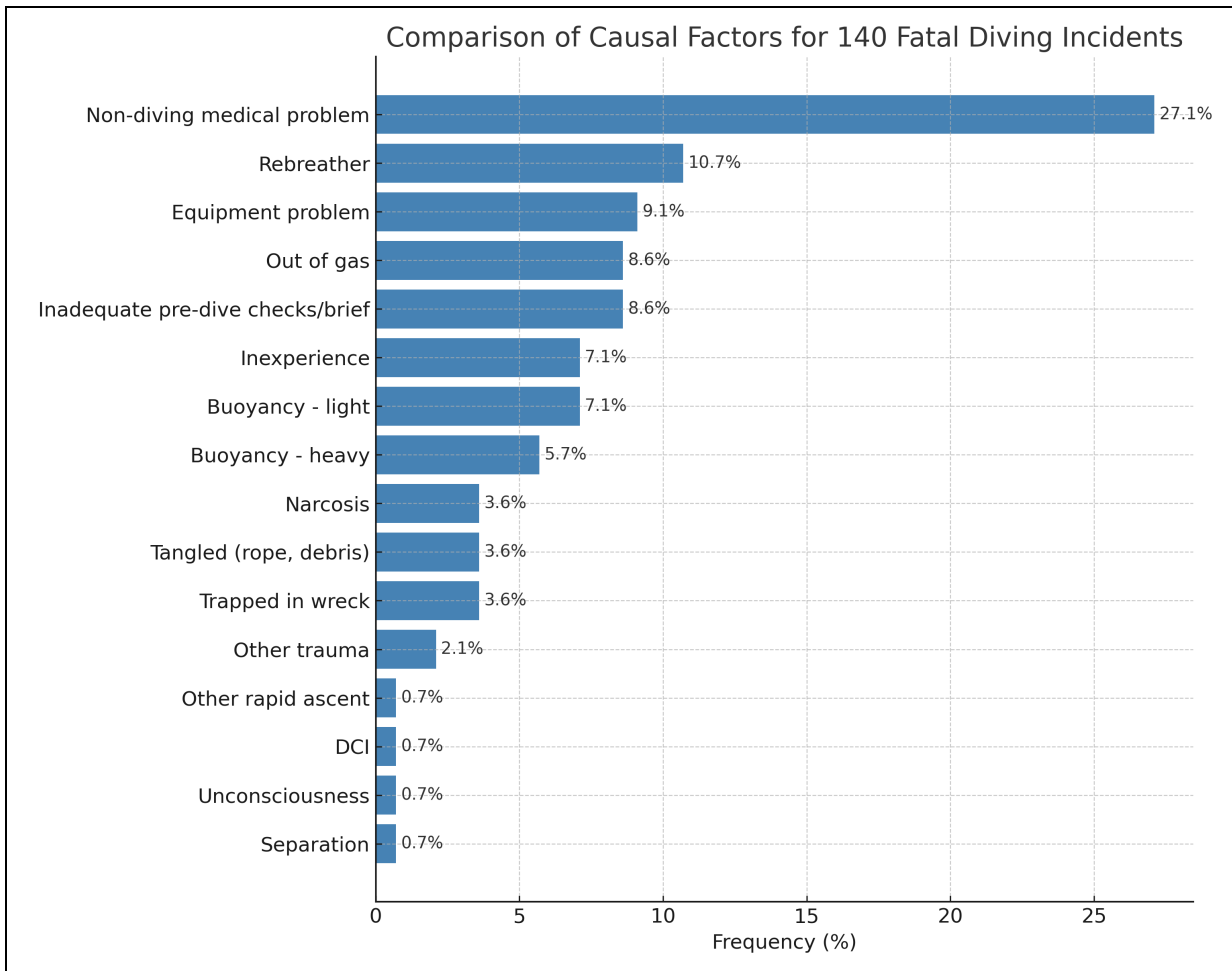


Figure 2 (Fatal incidents causes based on Gen Re data)

5.3 Among others in its report from 2023, BSAC reports stated:

“Analysis of the fatal incidents showed that the average age of the people who died was 58 years. age of people recorded in the incident database who were not casualties has been increasing.”¹²

¹¹ Watson https://www.researchgate.net/publication/247161649_British_Sub-Aqua_Club_A_review_of_the_nature_of_diving_in_the_United_Kingdom_and_of_diving_fatalities_in_the_period_1_st_Jan_1998_to_31_st_Dec_2009?enrichId=rgreq-6c830a6bac606eef502d357c7c2f4aa9-XXX&enrichSource=Y292ZXJQYWdlOzI0NzE2MTY0OTtBUzoxMDQxMjU1Mzg3NjY4NTRAMTQwMTgzNjg3MTQxNA%3D&el=1_x_3.

¹² See BSAC Diving Incident report 2023, page 17.

5.4 The key medical data are shown in Table 2 below:

Source	Sample	% Medical Cause	Average Age	Notable findings
GEN RE	140	27,1	55,5	Leading cause: cardiac
BSAC	9	N/A	58	Majority over 50
DAN	100+	Not Isolated	67%>50	Fitness and age are linked.

Table 2

6. Core Data Sources

Divers Alert Network (DAN)

6.1 Annual Diving reports are published by DAN. They are detailed reports encompassing statistics on dive fatalities, injuries and accidents, along with case studies. These reports provide insights into behavioral environmental risk factors associated with diving incidents. DAN also conducts surveillance studies analyzing diving fatalities¹³, which are presented at scientific conferences and published in peer-reviewed journals.¹⁴

6.2 The National Library of Medicine published an analysis “*DAN Annual Diving Report 2020 Edition: A report on 2018 diving fatalities, injuries, and incidents*” According to the report a

“...total of 67% of the fatalities recorded were 50 years of age or older... While increasing age does not increase fatality risk when diving directly, it may affect health and physical fitness; both of which can indirectly increase risk. ... While the average age of recreational divers is (in general) rising, there appears to be a plateau at around sixty to seventy years of age, which may correlate with the stabilization of the average age of fatalities.”

6.3 The same report is of course also accessible on DAN:s website. DAN concludes as follows:

“Most scuba fatalities occur in older divers and are related to health and fitness issues. A healthy lifestyle, staying fit, and regular medical checkups are pre-requisites for lifelong, healthy, participation in scuba diving.”

6.4 Unfortunatly later (post 2023) DAN Annual Diving Reports seems not yet available for now.

¹³ https://dan.org/research-reports/research-studies/surveillance-of-fatal-injuries-in-diving/?utm_source=chatgpt.com

¹⁴ Divers Alert Network, *Annual Diving Report 2020 Edition: A Report on 2018 Diving Fatalities, Injuries, and Incidents*, p. 11 and 24. Available at <https://www.dansa.org/annual-diving-report> or <https://apps.dan.org/publication-library>.

British Sub-Aqua Club (BSAC)

6.5 BSAC compiles annual reports detailing UK diving incidents, including those involving divers from all agencies and backgrounds. The 2023 report, for instance recorded 242 incidents with nine fatalities in the UK.¹⁵ . The 2023 report states among others that

“...the overseas reporting is dominated by reports of failures to mask and fin straps. This increase either points to an escalated thoroughness in reporting from a cohort of divers or a problem with kit maintenance...”

6.6 It also states that the trend is moving towards:

”... fewer incidents of DCI and fast ascents in the incident reports. ... and we helpfully note that we are seeing less DCI associated with diving deeper than 30 m, rapid ascents and missed stops. ...”

6.7 BSACs reports support the findings of the Gen Re report, that the major culprit of all incidents are medical issues.

Professional Association of Diving Instructors (PADI)

6.8 A study by Peter Buzzacott, Al Hornsby and Karl Shreeves, based on information provided by PADI as to Mortality rate among participants in the Discover Scuba Diving (DSD) program, provide mortality rates and insights into safety performance improvements over time.¹⁶ This study showed 0.87 fatalities per 100,000 participants, for the 1992–2008 period. The conclusion is that:

“...the data suggest the DSD mortality rate compares favourably with mortality in recreational scuba ... diving overall.”

Research Gate

6.9 Research Gate¹⁷ is another source of information.¹⁸ There you will find many articles related to the above sources but also other diving incident related incident publications as well.

DIVE – The Magazine Diving Deserves

6.10 While not being a diving agency this magazine publishes reports and findings about dive incidents, fatal or not. The magazine has been publishing articles and news since 1995.

¹⁵ https://www.bsac.com/safety/diving-incident-annual-diving-incident-report/?utm_source=chatgpt.com. As per Maj 15th, 2025 the report for 2024 is not yet available.

¹⁶ Peter Buzzacot, Al Hornsby and karl Shreeves, “Mortality Rate During Professionally Guided Scuba Diving Experiences for Uncertified Divers, 1992–2019”; *Wilderness & Environment Medicine*, vol 32, no.3 (2021) <https://pmc.ncbi.nlm.nih.gov/articles/PMC8426127/>.

¹⁷ <https://www.researchgate.net/>

¹⁸ Try typing “Diving incidents”; <https://www.researchgate.net/search/publication?q=Diving+incidents>

InDepth Magazine¹⁹

6.11 The Online Magazine InDepth was created and is strongly connected to Global Underwater Explorers (GUE) but not a part of said agency. It began its publishing in 2018. Its mission is to “... to supply readers with accurate, compelling, hand curated and researched, data-driven content to assist them in expanding their underwater envelope.”. InDepth is focused on technical diving and regularly publish articles and interviews about diving related to incidents or other information of interest. Sometimes the information can be found under the label “Data Matters” or “Education”.

6.12 For instance in the article “Examining Early Technical Diving Deaths; The aquaCORPS Incident Reports (1992-1996)” by Michael Menduno, an analysis of 44 incidents that resulted in 39 fatalities and 12 injuries, in the early to mid 1990s is made.²⁰

6.13 When it comes to OC Cave diving its less complex compared to CCR Cave diving. However the risks with diving in such conditions are the same. The CCR will however be more predominant as to the medical factors as well as the complexity factors.

Divinginfo.mt

6.14 Since I am a resident of Malta, the official statistic from Malta available from 2019-september 2024 has caught my attention.²¹ The information is a result of a parliamentary question dated September 17th, 2024. The answers are offered from the Hyperbaric Units in Malta and Gozo. As I understand it reflects divers treated at those facilities. According to the article 375 divers were treated at the Hyperbaric chambers in Malta and Gozo over the last five years as shown below in Table 3.

Year	Number of incidents
2019	45
2020	51
2021	74
2022	69
2023	66
2024 (09)	70

Table 3

6.15 In the article the following statement is made:

“the number of deaths averaged three a year, and in total 31 since 2014. 24 of these divers were not residents in Malta, hence 77% of the fatal accidents can be attributed to visitors.”.

¹⁹ <https://indepthmag.com/>

²⁰ Michael Menduno, “Examining Early Technical Diving Deaths: The aquaCORPS Incident Reports (192-196)” *InDepth Magazine*, <https://indepthmag.com/early-technical-diving-deaths/>

²¹ <https://www.divinginfo.mt/official-diving-accidents-statistics-in-maltese-islands-2024/>

6.16 This seem to support the findings about medical causes among recreational scuba divers and that it occurs when they are diving on vacations. The reported results does not distinguish between recreational and technical diving. However some specification are done as to the type of problem as shown in Table 4 below.

Year	Drowning while diving	Pressure change due to diving (barotrauma)	Total
2014	1	3	4
2015	0	4	4
2016	1	3	4
2017	3	0	3
2018	0	5	5
2019	1	1	2
2020	2	1	3
2022	0	1	1
2023	1	1	2
2024* (up to September)	0	3	3

Table 4 (Medical Incident Type based on Malta statistic)

6.17 Unfortunately several severe incidents occurred that does not seem to be included, at least not from September 2024 till December 2024.²²

2024.12.29 – Rescue services called to Ċirkewwa Diving Site to search for missing diver (later found safe and sound).

2024.10.16 – Two divers hospitalised after encountering difficulties in Ċirkewwa (reported as seemingly no life-threatening condition) However in divemagaizibe.com one of the divers died. His age was 66.²³

2024.09.24 – 51 year old Polish diver hospitalised following a dive at Xatt l-Aħmar, Gozo (the divers condition was reported as serious).

2024.09.10 – Five divers rescued at Wied iż-Żurrieq

6.18 The statistic above does not properly show the reality and fatalities Already in July 2024, one polish divers died. They were both CCR divers and dove the *Le Polynesian* wreck (appr 68 meters).²⁴ One later died had a cardiac arrest and the other diver suffered from AEG and pulmonary barotrauma and as far as information goes eventually also died. Apparently the divers encountered strong currents and surfaced without fulfilling their decompression obligation. The environmental risk factor seems to be dominant. Although both divers were experienced, strong currents may have prevented proper decompression maybe in conjunction with taskloading as a result of other problems occurred.

²² <https://www.divinginfo.mt/diving-related-accidents/>

²³ <https://divemagazine.com/scuba-diving-news/british-scuba-diver-dies-feeling-unwell-in-cirkewwa-malta>. Ther information in [divinginfo.mt](https://divernet.com/scuba-news/health-safety/british-diver-dies-in-malta-2/) contrast and only shows that reports may not be as accurate as could be wished for. Also <https://divernet.com/scuba-news/health-safety/british-diver-dies-in-malta-2/>

²⁴ <https://divers24.com/tragedy-strikes-in-malta-two-polish-divers-lose-their-lives/>

7. CRI evaluation

7.1 The CRI results in Table 5 below, needs an explanation apart from the fact I started of using the sources mentioned above. However nuance seemed prudent, and here are my rationale for it.

CCR Tech:

7.2 The fatality numbers are not known to me, and as such the score 4, is a qualified guess on my behalf. The score for Human Error when it comes to CCR Tech is not easy to set. At first glance the complexity might point to a reasonable 6 due discipline and redundancy. However other factors suggest a higher risk score, for instance additional monitoring tasks, PPO2 management, failing to bailout. I therefore settled for 7. To clarify or justify my scoring I would like to add that the 7 accounts for PPO2 management, bailout readiness and failures to properly monitor the HUD (Heads-Up Display). However, in the future I might refine this part of my paper by distinguishing between experienced CCR Tech Divers and recreational²⁵ CCR Divers. The Human Error factor would probably be lower for CCR Tech divers if such distinction was made, perhaps scoring 6 leading to a CRI of 5.6 $((4+6+8+4+6)/5)$.

Recreational CCR:

7.3 As far as I know, there is no statistic for recreational CCR diving yet. Therefore mortality rate is not easy to score. The score is set to 1 equal to recreational divers but I would like to emphasize it's only a qualified guess on my behalf. Even so, as for the medical score the older demographic studies on recreational scuba diving may not entirely be applicable on recreational CCR since the predominant factor here may not be age so much as wealth. Furthermore, recreational CCR divers may also be more aware of the importance of health, at least more so compared with average scuba tourists. Thus the score is set to 5.

OC and CCR Cave:

7.4 This is an unknown piece of information for me and CRI scoring is therefore a qualified guess on my behalf. Some of the accidents I have read about seems to involve insufficient gas supply and with a CCR this is less likely to happen. On the other hand CCR Cave diving introduces other hazards like loop failures and bailout failures (handling or refusal). However CCR divers are disciplined and well trained and the redundancy factor is important. CCR divers often have a background as OC Tech divers. In the end I opted for the same mortality score since the risks are qualitatively different but quantitatively equal.

Early Tech:

7.5 As for Early tech divers the data is old although stretching for a longer period. During the time of assembling the data diving techniques has evolved as has the equipment. The total CRI of 6.6 is high, maybe too high and there is room for refinement as to adjusting for incomplete training as well as novice technical divers and experienced technical divers. I acknowledge this potential flaw in the CRI and will leave it at that for now.

²⁵ I deliberately not use the word "causal" even though recreational diving can be so. The rationale is that diving a rebreather encompasses an extended technical training per se as how to operate a CCR that equals the CCR Tech diver. Having that said, a recreational dive is in general more relaxed and less stressful compared to a technical dive, or at least it should be.

	Fatality	Human Error	Equipment	Environment	Medical	CRI
OC rec	1	3	2	2	6	2.8
OC Tech	5	6	7	4	5	5.4
CCR Tech	4	7	8	4	6	5.8
CCR Rec	1	4	5	2	5	3.4
OC Cave	7	9	7	10	3	7.2
CCR Cave	7	7	9	10	7	8.0
Early Tech	8	9	8	7	4	7.2

Table 5

7.6 The findings shows that technical divers overall are more subjected to risks compared to recreational divers. Having that said it is interesting how similar the CRI score is for recreational scuba (OC) divers and recreational rebreather divers. This suggest that not only is it important to distinguish between the type of diving you are talking about but also recognize that just diving a rebreather does not mean you are a technical diver nor elevate the risks involved significantly.

7.7 As you already understand and based on the above sources, the medical risks seem to be a major factor of all incidents registered and especially when it comes to mortality rate. If we focus solely on that specific factor, my CRI scoring can be visualized as in the Figure 3 below, mainly based on the data from 140 fatal diving in the Gen Re-report and the analysis of said report by Brian Cumming, Clare Peddie and Jim Watson.

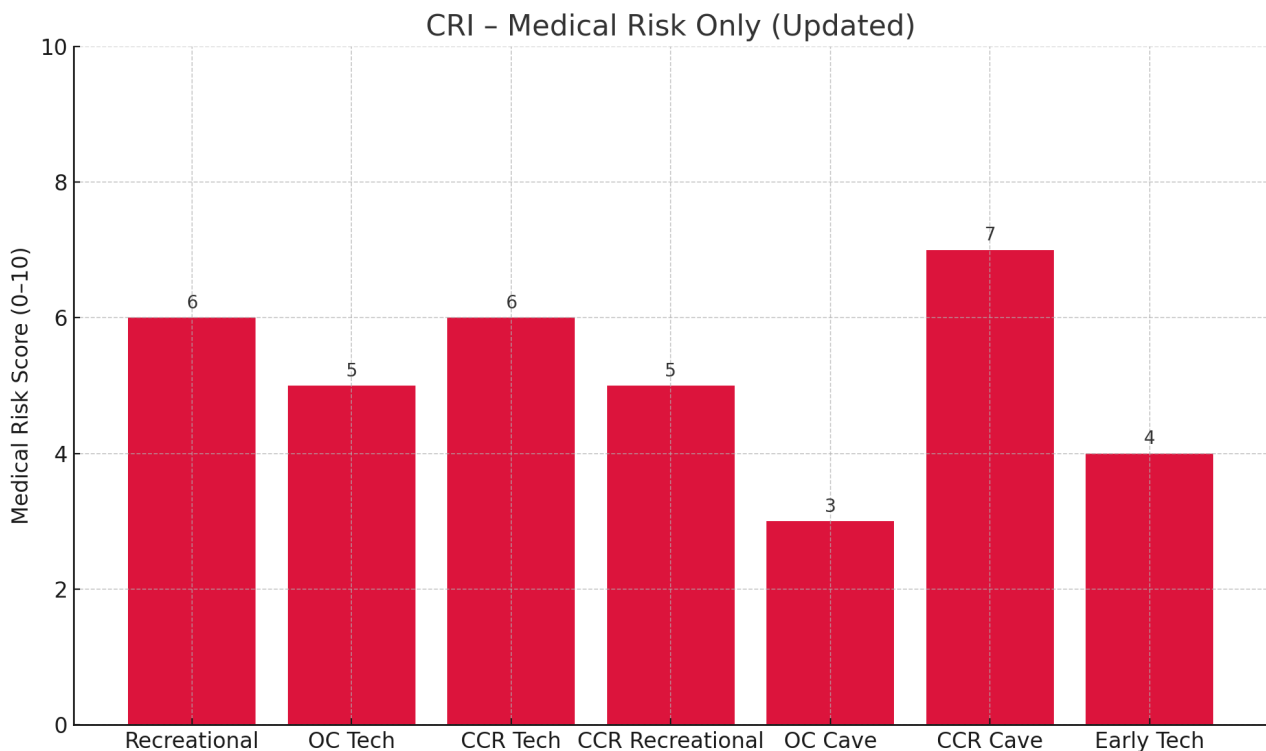


Figure 3 ((CRI Medical Risk Score by Diver Type based on data mentioned above)

7.8 The result is surprising. The medical factor seemingly plays a more important role in diving incidents compared to OC Technical diving, CCR recreational diving not to mention – OC Cave diving. The reason CCR Cave is so high can be explained by age mostly and of course the far more strenuous diving cave diving encompasses.

7.9 One conclusion based on the facts that the dominating factor among the reported diving incidents, regardless of outcome, is medical, suggest that although technical diving involves higher risks per se – it may not result in higher overall mortality than recreational scuba diving, depending on the population and scenario. My findings, flawed or not, also supports that recreational CCR diving from a medical point of view is less dangerous compared to recreational scuba diving.

8. Conclusion

8.1 In my humble opinion based on this very shallow analyze of a limited number of sources and my own-make CRI grading I do not find it justified to say that you die when involved in an incident just because you are involved in technical diving. However technical diving per se involves different risks and higher risks as to deep and equipment especially. Cave diving holds special risks with its overhead ceiling.

8.2 The most striking finding, however, is that medical problems seem to be greatest in recreational open circuit diving. One reason is probably overweight, another is age, and a third explanation is that recreational divers are less fit and limit their diving experience to vacations.

8.3 Another observation is that recreational rebreather diving is far less risky than one might expect – at least based on my CRI. Anyone who is of the opinion that technical divers die more often than open circuit scuba divers are in my opinion not entirely correct especially not when it comes to recreational rebreather diving. Table 6 below, encapsulates the key findings and concludes my article...for now.

Rec Diver	CCR Rec Diver	OC Tech Diver	CCR Tech Diver	OC Cave Diver	CCR Cave Diver
Predominant risk: <ul style="list-style-type: none"> • Medical • Human Error. 	Predominant risk: <ul style="list-style-type: none"> • Medical • Human Error 	Predominant risk: <ul style="list-style-type: none"> • Procedural • Medical 	Predominant risk: <ul style="list-style-type: none"> • Procedural • Medical 	Predominant risk: <ul style="list-style-type: none"> • Procedural • Environmental 	Predominant risk: <ul style="list-style-type: none"> • Procedural • Medical • Environmental
Description: <ul style="list-style-type: none"> * Cardiovascular events. * Gas depletion * Rapid ascents * Skipping buddy checks. * Diverse group with varying age, fitness and discipline. 	Description: <ul style="list-style-type: none"> * Cardiovascular events. * Improper ascent * PO2 monitoring errors * Group tends to be middle-aged or above and wealthier * May have better awareness of health and discipline * Risk from scrubber failure * Insufficient bailout readiness <p><i>Data is so far limited.</i></p>	Description: <ul style="list-style-type: none"> * Deep decompression dives require complex gas switching (e.g. DeTox) <p>Incidents often due to:</p> <ul style="list-style-type: none"> * Mismanaged PO2 * Missed decompression stops * Skipped pre-checks * Moderate to high equipment complexity * Medical risk increases with age 	Description: <p>Similar risks as OC Tech, but with added complexity:</p> <ul style="list-style-type: none"> * PO2 loop failures * Scrubber breakthrough * Bailout management * Fatalities often due to user errors, not hardware <p>Diver profile:</p> <ul style="list-style-type: none"> * Older * Experienced * Wealthier 	Description: <p>May include:</p> <ul style="list-style-type: none"> * Deep dives * Tight passages * Poor visibility * High task loading * Exertion <p>Common issues:</p> <ul style="list-style-type: none"> * CO2 hits * Insufficient gas * Entrapment * Environment adds major risk layer 	Description: <p>Similar to OC Cave, with added complexity</p> <ul style="list-style-type: none"> * Entrapment * Loop failure * Overexertion * High cognitive demands including task loading * Risks are magnified by older diver profiles.

Table 6