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Micromort

A **micromort** (from micro- and mortality) is a unit of risk defined as a one-in-a-million chance of death.[1][2] Micromorts can be used to measure the riskiness of various day-to-day activities. A **microprobability** is a one-in-a million chance of some event; thus, a micromort is the microprobability of death. The micromort concept was introduced by Ronald A. Howard who pioneered the modern practice of decision analysis.[3]

Micromorts for future activities can only be rough assessments, as specific circumstances will always have an impact. However, past historical rates of events can be used to provide a rough estimate.

Sample values

Baseline

Death from	Context	Time period	N deaths	N population	Micromorts per unit of exposure	Reference
All causes	England and Wales	2012	499,331	56,567,000	24 per day 8,800 per year	ONS Deaths[4] Table 5.
All causes	Canada	2011	242,074	33,476,688	20 per day 7,200 per year	Statistics Canada[5]
All causes	US	2010	2,468,435	308,500,000	22 per day 8,000 per year	CDC Deaths[6] Table 18.
Non-natural cause	England and Wales	2012	17,462	56,567,000	0.8 per day 300 per year	ONS Deaths[4] Table 5.19.
Non-natural cause	US	2010	180,000	308,500,000	1.6 per day 580 per year	CDC Deaths[6] Table 18
Non-natural cause (excluding suicide)	England and Wales	2012	12,955	56,567,000	0.6 per day 230 per year	ONS Suicides[7]
Non-natural cause (excluding suicide)	US	2010	142,000	308,500,000	1.3 per day 460 per year	CDC Deaths[6] Table 18.
All causes – first day of life	England and Wales	2007			430 per first day of life	Walker, 2014[8]
All causes – first year of life	US	2013			16.7 per day 6100 per year	CDC Life Tables[9] Blastland & Spiegelhalter, 2014[10]
Murder/homicide	England and Wales	2012/13	551	56,567,000	10 per year	ONS Crime[11]
Homicide	Canada	2011	527	33,476,688	15 per year	Statistics Canada[12]
Murder and non-negligent manslaughter	US	2012	14,173	292,000,000	48 per year	FBI[13] Table 16

Leisure and sport

Death from	Context	Time period	N deaths	N exposure	Micromorts per unit of exposure	Reference
Scuba diving	UK: BSAC members	1998–2009	75	14,000,000 dives	5 per dive	BSAC[14]
Scuba diving	UK: non-BSAC	1998–2009	122	12,000,000 dives	10 per dive	BSAC[14]

Scuba diving	US – insured members of DAN	2000–2006	187	1,131,367 members	164 per year as member of DAN 5 per dive	DAN[15] p75
Paragliding	Turkey	2004–2011	18	242,355 jumps	74 per jump	Canbek 2015[16]
Skiing	US	2008/9	39	57,000,000 days skiing	0.7 per day	Ski-injury.com[17]
Skydiving	US	2000–2016	413	48,600,000 jumps	8 per jump	USPA[18]
Skydiving	UK	1994–2013	41	4,864,268 jumps	8 per jump	BPA[19]
BASE jumping	Kjerag Massif, Norway	1995–2005	9	20,850 jumps	430 per jump	Soreide 2007[20]
Mountaineering	Ascent to Matterhorn	1981–2011	213	about 75,000 ascents (about 2500 per year)	about 2,840 per ascent attempt	Bachmann 2012[21]
Mountaineering	Ascent to Mt. Everest	1922–2012	223	5,656 successful ascents	37,932 per successful ascent	NASA 2013[22]

Travel

Activities that increase the death risk by roughly one micromort, and their associated cause of death:

- Travelling 6 miles (9.7 km) by motorcycle (collision)[23]
- Travelling 17 miles (27 km) by walking (collision)[23]
- Travelling 10 miles (16 km)[24] or 20 miles (32 km)[23] by bicycle (collision)[a]
- Travelling 230 miles (370 km) by car (collision) (or 250 miles)[23]
- Travelling 1,000 miles (1,600 km) by jet (collision)[24]
- Travelling 6,000 miles (9,656 km) by train (collision)[23]

Other

Increase in death risk for other activities on a per-event basis:

- Hang gliding – 8 micromorts per trip[23]
- Ecstasy (MDMA) – 0.5 micromorts per tablet, rising to 13 if using other drugs[26][27]
- Giving birth (vaginal) – 120 micromorts[28]
- Giving birth (caesarean) – 170 micromorts[28]
- AstraZeneca vaccination against COVID-19 – 2.9 micromorts[29]
- COVID-19 infection at age 10 – 20 micromorts
- COVID-19 infection at age 25 – 100 micromorts
- COVID-19 infection at age 55 – 4,000 micromorts
- COVID-19 infection at age 65 – 14,000 micromorts
- COVID-19 infection at age 75 – 46,000 micromorts

- COVID-19 infection at age 85 – 150,000 micromorts (As of December 2020)[30]

Value of a micromort

Willingness to pay

An application of micromorts is measuring the value that humans place on risk. For example, a person can consider the amount of money they would be willing to pay to avoid a one-in-a-million chance of death (or conversely, the amount of money they would receive to accept a one-in-a-million chance of death). When offered this situation, people claim a high number. However, when looking at their day-to-day actions (e.g., how much they are willing to pay for safety features on cars), a typical value for a micromort is around $50 (in 2009).[31][32] This is not to say the $50 valuation should be taken to mean that a human life (1 million micromorts) is valued at $50,000,000. Rather, people are less inclined to spend money after a certain point to increase their safety. This means that analyzing risk using the micromort is more useful when using small risks, not necessarily large ones.[32]

Value of a statistical life

Government agencies use a nominal Value of a Statistical Life (VSL) – or Value for Preventing a Fatality (VPF) – to evaluate the cost-effectiveness of expenditure on safeguards. For example, in the UK, the VSL stands at £1.6 million for road improvements.[33] Since road improvements have the effect of lowering the risk of large numbers of people by a small amount, the UK Department for Transport essentially prices a reduction of 1 micromort at £1.60. The US Department of Transportation uses a VSL of US$6.2 million, pricing a micromort at US$6.20.[34]

Chronic risks

Micromorts are best used to measure the size of *acute* risks, i.e. immediate deaths. Risks from lifestyle, exposure to air pollution, and so on are *chronic* risks, in that they do not kill straight away, but reduce life expectancy. Ron Howard included such risks in his original 1979 work,[24] for example, an additional one micromort from:

- Drinking 0.5 liter of wine (cirrhosis of the liver)[24]
- Smoking 1.4 cigarettes (cancer, heart disease)[24]
- Spending 1 hour in a coal mine (black lung disease)[24]
- Spending 3 hours in a coal mine (accident)[24]
- Living 2 days in New York or Boston in 1979 (air pollution)[24]
- Living 2 months with a smoker (cancer, heart disease)[24]
- Drinking Miami water for 1 year (cancer from chloroform)[24]
- Eating 100 charcoal-broiled steaks (cancer from benzopyrene)[24]
- Traveling 6000 miles (10,000 km) by jet (cancer due to increased background radiation)[35]

Such risks are better expressed using the related concept of a microlife.

See also

- Decision analysis – Discipline covering formal decision making
- Decision theory – Branch of applied probability theory
- Ellsberg paradox – Paradox in decision theory
- List of unusual units of measurement – Units of measurement that are not part of a coherent system
- Microlife – Unit of risk – half an hour of life expectancy

- Pascal's Wager – Argument that posits human beings bet with their lives that God either exists or does not
- Precautionary principle – Risk management strategy
- Risk of ruin – Concept in gambling, insurance, and finance

Notes

a. however due to the health effects of cycling the net effect of cycling on life expectancy is likely positive in most cases[25]

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External links

- Micromorts - We are all going to die (https://micromorts.rip/)