

Military fatality rates (by cause) in Afghanistan and Iraq: a measure of hostilities

Sheila M Bird^{1*} and Clive B Fairweather²

Accepted	16 April 2007
Background	Military fatalities occur in clusters, and causes differ between theatres of operation or within-theatre over time.
Aim	Based on around 500 coalition deaths, identify major causes in Iraq and Afghanistan. For consecutive periods (1: May 1 to September 17, 2006, 2: September 18, 2006 to February 4, 2007), ascertain UK and others' numbers deployed to compare fatality rates per 1000-personnel years. Take account of clustering: deaths per fatal improvised explosive device (IED) incident, and in making short-term projections for Afghanistan.
Methods	Cause and date of coalition deaths in Iraq and Afghanistan are as listed in http://www.iCasualties.org , where each death is designated as hostile or non-hostile. Numbers deployed in 2006 were available for UK and Canada, and for US to Iraq.
Findings	<p>Out of 537 coalition fatalities in Iraq in 2006 to September 17, 2006, 457 (85%) were hostile, but only half were in Afghanistan (October 2001 to September 17, 2006: 52%, 249/478). Air losses accounted for 5% fatalities in Iraq, but 32% in Afghanistan. IEDs claimed three out of five hostile deaths in Iraq, only a quarter in Afghanistan. Deaths per fatal IED incident averaged 1.5.</p> <p>In period 1, 50/117 military deaths in Afghanistan were UK or Canadian from 6750 personnel, a fatality rate of 19/1000/year, nearly four times the US rate of 5/1000/year in Iraq (based on 280 deaths). Sixty out of 117 fatalities in Afghanistan occurred as clusters of two or more deaths.</p> <p>In period 2, fatality rates changed: down by two-thirds in Afghanistan for UK and Canadian forces to 6/1000/year (18 deaths), up by 46% for US troops in Iraq to 7.5/1000/year (416 deaths).</p>
Interpretation	Rate, and cause, of military fatalities are capable of abrupt change, as happened in Iraq (rate) and Afghanistan (rate and cause) between consecutive 140-day periods. Forecasts can be wide of the mark.
Keywords	Military fatality rates, specific causes of death, clusters, short-term projections

Introduction

Keeping a track on fatalities and injuries by cause,¹ and on variations in the number of troops deployed to a theatre of war, such as Iraq² or Afghanistan,^{3,4} provides indications of cause-specific trends; and serves as a reference from which to monitor

major changes, some of them sudden. Trends in military fatalities due to improvised explosive devices (IEDs) or suicide bombings^{1,4} are of military or media interest respectively.

For analysis purposes, a force of 1000 servicemen and women on operations for 1 year constitutes 1000 personnel-years (pys); and so too does a deployment of 4000 personnel for a quarter year. Insightful analysis involves not only the numbers of military fatalities by nationality and cause, but computation of rates per 1000 pys.²

An equivalent tally should be kept up for other nations⁴ besides our own because the combined data may offer a more

¹ MRC Biostatistics Unit, Cambridge CB2 2SR.

² Combatstress, Leatherhead KT22 0BX.

* Corresponding author. MRC Biostatistics Unit, Robinson Way, Cambridge CB2 2SR. E-mail: Sheila.bird@mrc-bsu.cam.ac.uk

secure platform for drawing inferences, and making projections.^{1,4} Corresponding period-specific counts for the enemy (of fatalities, casualties and numbers deployed) and of civilian collateral damage—both direct^{5–7} and indirectly^{6–8}—give a rounded, quantitative understanding of fighting efficiencies, and the broader impact of war. The fatality rate of the Taliban's 'foot soldiers from among the poor, ordinary Afghan tribesmen,'⁹ the extent of their losses,¹⁰ and how readily those who die can be replaced by new recruits are critical questions, both epidemiologically and militarily, but are beyond the scope of this article.

Our analysis of the rate, causes and clustering of military deaths in Afghanistan and, in 2006, in Iraq updates earlier articles on UK's military fatality rates per 1000 pys since March 20, 2003 in Iraq,² and on the need for military and public health sciences to collaborate.^{5–7} Clustering was tragically evident on September 2, 2006 when a Nimrod came down in southern Afghanistan with the loss of 14 British lives.

Moderately sophisticated analysis should be publicly reported for democratic assurance¹¹ that statistical science is being deployed in the service of our forces—as diligently as medico-surgical skills are.¹² Anticipated or empirical risks can then be rapidly redressed.^{13–15} In Afghanistan, by straightforward empirical measures, the threat to our forces was major in mid 2006.³

Coalition fatalities were approximately 500 in markedly different theatres and periods of operation (Afghanistan from October 1, 2001 to September 17, 2006, and Iraq from January 1, 2006 to September 17, 2006). Differences between these theatres of operation include that the coalition entered Iraq as an invasion force, not so Afghanistan. Terrain and seasonality are quite diverse between Afghanistan and Iraq. An urban focus to military operations in Iraq necessitates the use of central road configurations. Different cross-border and illegal supply lines to the enemy apply in Afghanistan and Iraq. And eradication of the opium poppy crop threatens livelihoods in Afghanistan, which has a long-established fighting tradition.

Methods

First, we compare causes of death between theatres of operation. Thereafter, our focus is on comparing (national) fatality rates in consecutive 140-day periods (May 1, 2006 to September 17, 2006; September 18 to February 4, 2007) in Afghanistan and Iraq; and on the clustering of fatalities by IEDs or air-related. We test a 70-day ahead projection for UK and Canadian fatalities in Afghanistan which took clustering into account. Not all fatality rates can be estimated, however, because relevant denominators (period-specific troop numbers by nationality) are lacking.

Data on fatalities by date, place and cause have been derived from the iCasualties.org website,¹⁶ to which we make acknowledgement. On iCasualties.org, each fatality is designated as 'hostile' or non-hostile. We use this designation, but have no means of its verification. Non-hostile deaths include illness, accidents (vehicular, in the air, other), injury and suicide. Information on date or cause of death is liable to minor change between dates of accessing iCasualties.org.

We imposed an hierarchical coding for major causes of death as follows: airplane or helicopter, IED, rocket-propelled grenade (RPG), suicide bomber, small arms fire, all other causes. This avoids double-counting of those deaths for which more than one contributory cause was cited. Thus, if a helicopter was brought down by RPG attack, the fatalities were coded to helicopter; and if a soldier died by small arms fire and RPG attack, the death was coded to RPG.

Short-term forecasts of military fatalities can either assume Poisson variation, which entails no clustering, or can take clustering explicitly into account by recognizing that deaths occur singly, in small clusters of mean size m_1 , or in rarer large clusters of mean size m_2 . Poisson variation comes into the second approach by way of estimating the expected number of singleton deaths, expected number of small clusters and in giving the probability of occurrence of one or more large clusters. We illustrate short-term 70-day forecasts by both methods.

Uncertainty or 95% confidence intervals (95% CI) are used interchangeably and, because they pertain to 140-day periods or longer, are Poisson based. Thus, uncertainty may be underestimated by failing to account fully for extra-Poisson variation.

How fatalities were attributed may differ in the level of detail provided to iCasualties.org between access times and also between Operation Enduring Freedom (Afghanistan) and Operation Iraqi Freedom. Terminologies differ between nations which deployed forces. For example, the two classifications, aircraft and airplane, need to be pooled. Notice also that friendly fire deaths can be designated as either 'hostile' or 'non-hostile', and so both need to be searched, and their totals added.

Deducing the number of deaths per fatal IED incident was primarily based on coincidence of date and place of death, as publicly reported on the Iraq Coalition Casualty Count site (<http://www.icasualties.org/oif/Details.aspx>, accessed September 23, 2006, February 9, 2007 and March 20, 2007). Exceptionally, commonality of military unit strongly suggested coincidence.

Finally, for definiteness, 10 fatal IED incidents in Iraq in 2006 were excluded from our analysis of deaths per fatal IED incident, as follows: disarming IED (three fatalities) and 12 fatalities in seven incidents that involved both small arms fire and IED (<http://www.icasualties.org/oif/Details.aspx>, accessed on September 23, 2006, February 9, 2007 and March 20, 2007).

US's deployment to Iraq was cited as 145 000 in September 2006,¹⁷ and has been assumed to have been roughly this number throughout 2006 to February 4, 2007. In Afghanistan, British marines took over from the parachute regiment in late September 2006, and thereafter UK's operational deployment to Afghanistan increased by some 500 to 750 troops from 4500 hitherto. After 9 months under British leadership, command of International Security Assistance Force in Afghanistan passed to an American general on February 4, 2007.¹⁸

Results

Overview of approximately 500 coalition fatalities per theatre of operation: Afghanistan and Iraq

Table 1 shows that, from January 1 to September 17, 2006 (260 days), there were 537 coalition deaths in Iraq, of whom

Table 1 Epoch-specific military fatalities by nationality in Iraq and Afghanistan

Theatre	Iraq			Afghanistan			
	Jan 1 to Sept 17, 2006 (260 days)	May 1 to Sept 17, 2006 (140 days)	Sept 18, 2006 to Feb 4, 2007 (140 days)	Oct 1, 2001 to Sept 17, 2006	Jan 1 to Sept 17, 2006 (260 days)	May 1 to Sept 17, 2006 (140 days)	Sept 18, 2006 to Feb 4, 2007 (140 days)
Epoch							
Total Fatalities	537	299	436	478	153	117	40
US	505	280	416	339	80	54	18
UK	20	14	12	40	35	33	6
Canada	No deployment			32	24	17	12
Other	12	5	8	67	14	13	4

(Rough-guide to deployments in 2006: approximately 145 000 US troops and over 7000 UK troops to Iraq; around 4500 UK troops and 2250 Canadian troops to Afghanistan: see also Methods and text).

505 (94%) were US troops and 20 (4%) from UK, these totals being broadly proportionate to respective deployments. From October 2001 to September 17, 2006 (nearly five years), there were 478 coalition deaths in Afghanistan, of whom 339 (71%) were US troops, 40 from UK and 32 from Canada. However, nearly one-third (153/478) of the military deaths in Afghanistan to September 17, 2006 occurred in 2006 itself, when US's deployment had sharply reduced, and its proportion of fatalities also: down from 80% (259/325) prior to 2006 to around half thereafter, including up to February 4, 2007 [51%: (80 + 18)/(153 + 40), 95% CI from 44 to 58%].

Overview of major hostile causes of military fatalities in Iraq in 2006, and overall in Afghanistan: both to September 17, 2006

The vast majority of coalition fatalities in Operation Iraqi Freedom in 2006 to September 17 (85%: 457/537) was ascribed as hostile. Hostilities per se accounted for only about half of the overall fatalities in Afghanistan since 2001 (52%: 249/478 with 95% CI from 48% to 57%). In Afghanistan, however, the proportion of fatalities due directly to hostilities increased markedly over time (chi-square = 17 on 2 degrees of freedom, $P < 0.001$) having been 41% pre-2005 (80/195: 95% CI from 34 to 48%), 56% in 2005 (73/130) but 63% in 2006 to September 17 (96/153: 95% CI from 55 to 70%). Selected causes of death claimed a different toll in Iraq in 2006 and overall in Afghanistan.

In particular, IEDs accounted for 53% of all fatalities in Iraq in 2006 to September 17, and for 62% of hostile deaths (282/457: 95% CI from 57 to 66%). But IEDs accounted for only 13% of fatalities overall in Afghanistan and, more or less consistently, for around 25% of hostile deaths (63/249: 95% CI from 20 to 31%). There were, in fact, 28 IED fatalities in 2006 to September 17 (out of 153 coalition deaths in Afghanistan, that is: 18%) compared with only 15 IED deaths out of 195 (8%) fatalities pre-2005 but, as mentioned above, hostile deaths had increased sharply over time.

Downed helicopters and aircraft, which accounted for only 5% of fatalities in Iraq in 2006 (to September 17), claimed 151 out of 478 coalition lives (32%) overall in Afghanistan, 39 of them in 2006 (to September 17: or 25%, that is 39/153).

To September 17, 2006, RPGs accounted for only five out of 457 hostile deaths (1%) in Iraq in 2006, but for 13 out of 249 hostile deaths overall in Afghanistan (5%), most of these, significantly, having occurred in 2006 when RPGs claimed 10/96 (10%) hostile deaths.

Small arms fire was responsible for 61 out of 457 hostile deaths (13%); and for 61 out of 175 non-IED hostile deaths (35%: 95% CI from 28 to 42%) in Iraq in 2006 (to September 17). Similarly, small arms fire accounted for 29 out of 249 hostile deaths overall (12%) in Afghanistan; but for only 29 (16%) out of 186 non-IED hostile deaths. However, as with RPG fatalities, all but one of the deaths in Afghanistan ascribed to small arms fire occurred in 2006, so that in 2006 (to September 17) small arms fire contributed to 28 out of 96 hostile deaths (29%: 95% CI from 20 to 38%) in Afghanistan; and to 28 out of 68 non-IED hostile deaths (41%), the latter comparable with Iraq in 2006.

Finally, suicide bombers claimed the same number (14) of coalition fatalities in Iraq in 2006 (to September 17) as in Afghanistan overall. Friendly fire had cost no lives in Iraq in 2006 (to September 17), where US and UK troops operate in different regions, but 11 in Afghanistan overall.

Fatal IED incidents in Iraq throughout 2006 to February 4, 2007

Table 2 shows that there were 271 deaths in 183 fatal IED incidents in Iraq in 2006 to September 17 and 222 deaths in 142 fatal IED incidents in the subsequent 140 days, a pooled mean of 1.52 deaths per fatal IED incident.

The IED-fatality distributions for Iraq in-2006-to-September-17 and for the subsequent 140 days are highly consistent one with the other (chi-square goodness of fit on 3 degrees of freedom = 1.47). Moreover, pooled, they also give a surprisingly good fit to the overall data (to February 4, 2007) from Afghanistan on 76 IED deaths in 46 fatal IED incidents (chi-square goodness of fit on 2 degrees of freedom = 1.7), (Table 2).

Military fatality rates in Afghanistan and Iraq: compared in consecutive 140-day periods

The International Security Assistance Force in Afghanistan was under British command from May 2006, when UK's operational deployment to Afghanistan was about 4500 as compared with around 2250 Canadian troops and about 7200 UK troops in Iraq. In the subsequent 140 days (September 18, 2006 to February 4, 2007), UK troop numbers may have increased by 500–750 in Afghanistan, but decreased modestly to 7000 in Iraq.

From May 1 to September 17, 2006, Table 1 showed 117 coalition fatalities in Afghanistan, which included 54 US, 33 UK, 17 Canadian and 13 other nations' deaths. UK and Canadian fatalities in Afghanistan were broadly proportionate

Table 2 Frequency distribution for deaths per fatal IED incident in Iraq in 2006 through to February 4, 2007, and overall in Afghanistan

Number of deaths in a fatal IED incident	Fatal IED incidents in IRAQ			AFGHANISTAN	
	Jan 1 to Sept 17, 2006 (271 IED deaths in 183 fatal IED incidents)	Sept 18 to Feb 4, 2007 (222 IED deaths in 142 fatal IED incidents)	Pooled data on 493 IED deaths in 325 fatal IED incidents	76 IED deaths in 46 fatal IED incidents from Oct 1, 2001 to Feb 4, 2007 (and Iraq-based expected numbers)	
1	128	96	224	28 (31.7)	
2	33	23	56	11 (7.9)	
3	14	13	27	2 (3.8)	
4	5	9	14	5 (2.0)	
5	3	1	4	0 (0.6)	
Total	183	142	325	46 (46.0)	

Bold entries are pooled/total area.

Table 3 Coalition fatalities by cause in Operation Enduring Freedom in the 140 days from May 1 to September 17, 2006; and during subsequent 140 days

Period	Total facilities	iCasualties.org designation of fatality as:		Fatalities by selected cause in Afghanistan (coded hierarchically, see footnote and Methods)				
		Hostile	Non-hostile	Airplane or Helicopter	IED	RPG	Suicide bomber	Small Arms Fire
Fatalities by cause: May 1 to September 17, 2006 (17 clusters: 10@2, 3, 3, 3, 3, 4; 10, 14 =60 clustered deaths)								
First 140 days:	117	76	41	H14+A15	14	10	7	19
Cluster mean, SD	3.5, SD 3.3							
Cluster mean, SD for 15 clusters with fewer than 7 fatalities	2.4, SD 0.6							
Fatalities by cause: September 18, 2006 to February 4, 2007 (7 clusters: 2, 2, 2, 2, 3, 3, 4=18 clustered deaths)								
Second 140 days:	40	36	4	0	13	7	8	3
Cluster mean, SD	2.6, SD 0.8							

IED=Improvised Explosive Device, RPG=Rocket Propelled Grenade. Table 3 is based on iCasualties.org but imposes hierarchical coding of causes of death (left to right) so that if helicopter is brought down by RPG attack, the fatalities are coded to Helicopter and if a soldier died in small arms fire and RPG, the death is coded to RPG.

Bold entries indicate a) main results and b) number of fatalities in clusters of 7+ fatalities.

to their respective deployments so that 50 deaths in 140 days from a combined deployment of around 6750 personnel (that is: 2589 pys) gave a high UK and Canadian fatality rate of 19/1000/year (Poisson uncertainty: 14 to 25).

Coalition fatalities in Afghanistan reduced by two-thirds during September 18, 2006 to February 4, 2007 when there were 40 deaths: 18 US, 6 UK, 12 Canadian and four from other nations. In this second 140-day period, UK and Canadian military fatality rate had reduced to 18 deaths from a combined deployment of 6750 to 7500 personnel (that is: 2589 or 2877 pys), and so to between 6.3 and 7/1000/year (Poisson and deployment uncertainty: 4.1 to 11.0 or 3.7 to 9.9/1000/year).

Canadian troops did not deploy to Iraq. Table 1 showed that, from May 1 to September 17, 2006, 299 military fatalities in Iraq included 280 US, 14 UK and five other nations' deaths. US's military fatality rate in these 140 days from an estimated deployment of 145 000 personnel (that is: 55 616 pys) was thus 5.0/1000/year (Poisson uncertainty: 4.4 to 5.6/1000/year); and similarly for UK troops (but wider Poisson uncertainty: 2.8 to 8.5/1000/year).

In contrast to Afghanistan, coalition fatalities in Iraq increased dramatically by 46% during September 18, 2006 to February 4, 2007 when there were 437 deaths: 417 US, 12 UK and eight from other nations. In this second 140-day period,

US's military fatality rate increased to 7.5/1000/year (Poisson uncertainty: 6.8 to 8.2).

Clustering and cause of military fatalities in Afghanistan: compared in consecutive 140-day periods

Coalition fatalities in Afghanistan are shown summarily in Table 3 for May 1 to September 17, 2006 (140 days), and the subsequent 140 days.

Sixty out of 117 fatalities from May 1 to September 17, 2006 occurred as 17 clusters of two or more deaths. Downed aircraft or helicopter can account for large clusters of fatalities, as in the 14 and 10 fatalities reported in Table 3, or for few—as in four other incidents. Mean size and standard deviation for smaller clusters (fewer than seven fatalities) were similar between periods because, in the subsequent 140 days, there were no large clusters of fatalities in aircraft or helicopter.

The majority of hostile deaths during May 1 to September 17, 2006 was attributable to small arms fire, IEDs and RPG attacks. Suicide bombers caused seven military fatalities. Non-hostile deaths were about two per week (41), which included 25 fatalities in the air.

The lower number of military deaths during September 18, 2006 to February 4, 2007 was due, essentially, to no fatalities

in the air, a major reduction in deaths from small arms fire (down from 19 to three), and to a marked reduction also in non-hostile deaths (down from 16 non-air-related to only four).

Short-term, 70-day projection of military fatalities in Afghanistan: September 18 to November 26, 2006

Based on Table 3, if the next 70 days had continued with the pattern and deployments set by the past 140 days, then we may have expected: (i) 25 UK and Canadian fatalities (Poisson uncertainty: 15 to 35), two-thirds of them British.

Alternatively, consider first that 60/117 fatalities in Afghanistan had occurred in 17 clusters (two large clusters with mean of 12 fatalities; and 15 other clusters which accounted for 36 deaths, and so mean of 2.4 deaths). Notice that 12 fatalities per large cluster is similar to a mean of 11.4 based on 80 fatalities in seven previous air disasters in Afghanistan since October 2001, in each of which 7+ lives were lost. Second, note that UK and Canadian forces accounted for 50/117 fatalities. Therefore, we may have expected: (ii) 12.2 singleton fatalities (that is: $50/117 \times 57 \times 0.5$ period), 3.2 small clusters (that is: $50/117 \times 15 \times 0.5$ period) with a mean of 2.4 deaths per cluster (or 7.7 deaths), plus a 28% chance that a single large cluster of fatalities occurs (with expected 12 deaths) and a 7% chance of their being two or more such large clusters. The 28% probability derives from Poisson distribution with large cluster expectation of 0.42 (that is: $50/117 \times 2 \times 0.5$ period). Thus, there was a 65% chance that UK and Canadian deaths from September 18 to November 26, 2006 would be 20 in expectation, but a 35% chance that expected deaths could be 32 or worse.

In reality, UK and Canadian fatalities were 11 [one UK+10 Canadian, in six incidents (1+1, 1, 2, 2, 4)], and so significantly low ($P=0.05$, 2-tail test) even against an expectation of 20 in the absence (as transpired) of any large cluster of deaths.

Discussion

Coalition forces entered Afghanistan on a totally different basis than Iraq. Afghanistan's terrain and warlike history shape Taliban tactics. In 2006, a professional, non-conscripted army fought them closely and doggedly, and could call in air strikes. Yet, historical comparison shows that the UK and Canadian fatality rate in Afghanistan during May 1 to September 17, 2006 was as bad as for the much larger Soviet force over 20 years ago:^{19,20} 85 000 Soviets at outset of the 1980s, but 118 000 by 1985,¹⁹ with deaths averaging 1577 a year in 1980–82, and 1848 in 1984–86.²⁰ And mirrored the fatality rate in guerrilla-fighting of the UK's Special Air Service in Oman, 1970–76.²¹

Contemporary comparison—Iraq vs Afghanistan, 2006—showed that the fatality rate was 4-fold lower in Iraq but then rates in both theatres altered in opposite directions, so that each became as great as during major combat in Iraq in 2003.²

Military fatality rates can, and do, change abruptly. Abruptness was exemplified in Afghanistan by the failure

of our 70-day-ahead projection to anticipate as few as 11 UK and Canadian fatalities, despite having taken account of the clustering of military deaths.

Suddenly changed fatality rates occur with, or without, alteration in the distribution of specific causes.^{22, 23} In Iraq throughout 2006, half the military deaths were always due to IEDs despite a major up-regulation in hostilities. Two-thirds reduction in deaths in Afghanistan was cause-specific, however: no fatalities in the air, major reduction in deaths due to small arms fire and in non-hostile deaths.

In 2006, air losses accounted for 1 in 20 fatalities in Iraq but claimed one in five lives lost in the very different landscape of Afghanistan. Spectacularly similar between Iraq and Afghanistan was the average number of deaths (1.52) per fatal IED incident, reflecting vehicle-associated clustering. Central roads and urban focus to fighting in Iraq vs open, tracked terrain in Afghanistan facilitate the deadly efficient use of IEDs in the former, as does cross-border access to supplies and technical know-how.

Air losses and IEDs cause small size (2–6, cluster mean 2.5 deaths) or large (7+ fatalities) clusters of deaths. Occasional large clusters make for fraught short-term forecasting as there is insufficient time for observed and expected cluster counts to match up. Worse, change of tactics, strategy or tempo by the enemy or by our commanders, as when the British negotiated a Taliban withdrawal from Musa Qala,¹⁸ gives the lie to short-term forecasting, as with UK and Canadian fatalities in Afghanistan. Canada's high toll of fallen,⁴ relative to deployment, may not have changed between periods, however—major air losses had contributed to both US (10) and UK (14) but not to Canadian fatalities in the earlier period.

With seasonal and command changes again unfolding alongside the lottery of poppy eradication, 'same pattern as before' is doubtful for the 140 days to June 24, 2007. On current deployments and seasonal 60: 40 basis from Table 3, we expect 25 UK and Canadian fatalities (as singleton deaths or in small clusters) but with added 24% chance of single large cluster, and 5% chance of two or more large clusters of deaths.

The high death toll from our forces in Afghanistan in mid 2006 was halfway to the humanitarian disaster rate, 36.5 deaths/1000/year.²⁴ Fit, young soldiers were dying in war in Afghanistan at a rate greater than heroin-injecting exerts back home, 10/1000/year.²⁵ Why eradicate Afghanistan's opium poppies, which risks impoverishing local people and losing hearts and minds? Why not purchase instead—for use as diamorphine²⁵ or, more controversially, prescribed heroin? Some alliance of military, economist and public health minds is needed.

Conflicts of interest: C.B.F. served 13 years in the Special Air Service, including in Oman, and is Appeals Director for Combatstress in Scotland. S.M.B. chaired the Royal Statistical Society's Working Party on Performance Monitoring in the Public Services, and resigned from an Office for National Statistics committee overseeing research access to national mortality and morbidity data because of decisions which threatened the integrity of a military study. S.M.B. has made donations to Combatstress.

KEY MESSAGES

- Fatality rates changed in opposite directions in Iraq and Afghanistan between consecutive 140-day periods.
- Fatality rates became comparable during September 18, 2006 to February 4, 2007, both as high as during the initial phase of major combat in Iraq.
- IEDs accounted for 62% of hostile deaths in Iraq, much higher than in rural Afghanistan. The distribution of fatalities per fatal IED incident was the same, however.
- Specific causes of military deaths may differ not only between theatres of operation but also over time within-theatre, for example: small arms fire in Afghanistan.
- Due to operational changes, short-term forecasts of military fatalities can be wide of the mark, but should account for the chance of a large cluster of fatalities.

References

- Bruce I. Soldiers giving out sweets killed by bomber. Available at: <http://www.thrherald.co.uk/news/70327.html> (Accessed September 21, 2006).
- Bird SM. UK statistical indifference to its military casualties in Iraq. *Lancet* 2006;**367**:713–71.
- Sample I. Study highlights perils of Afghan service. *Guardian Unlimited* 2006; September 7. Available at: <http://guardian.co.uk/afghanistan/story/0,,1866822,00.html>.
- Staples S, Robinson B. Canada's fallen. Understanding Canadian military deaths in Afghanistan. *Foreign Policy Series* 2006;**1**:1–13 (September 2006; Canadian Centre for Policy Alternatives).
- Bird SM. Military and public health sciences need to ally. *Lancet* 2004;**364**:1831–33.
- Roberts L, Lafta R, Garfield R, Khudhairi J, Burnham G. Mortality before and after the 2003 invasion of Iraq: cluster sample survey. *Lancet Online* 2004; October 29 (Available at: <http://image.thelancet.com/extras/04art10342web.pdf>) and *Lancet* 2004;**364**:1857–64.
- Burnham G, Lafta R, Doocy S, Roberts L. Mortality after the 2003 invasion of Iraq: cross-sectional cluster sample survey. *Lancet Online* 2006; October 13: doi:10.1016/S0140-5736(06)69491-9.
- Bilukha OO, Brennan M, Woodruff BA. Death and injury from landmines and unexploded ordnance in Afghanistan. *JAMA* 2003;**290**:650–53.
- Norton-Taylor R. Browne fears deeper Afghan conflict. Available at: <http://www.guardian.co.uk/military/story/0,,1876558,00.html> (Accessed September 21, 2006).
- BBC News. 'Militants' die in Afghan clash. Available at: http://news/bbc.co.uk/1/hi/world/south_asia/5362796.stm (Accessed September 21, 2006).
- Royal Statistical Society Working Party on Performance Monitoring in the Public Services (chair: Professor Sheila M. Bird). *Performance Indicators: Good, Bad, and Ugly*. Royal Statistical Society, London: October 23, 2003. Available at: <http://www.rss.org.uk/pdf/PerformanceMonitoringReport.pdf> (Accessed July 11, 2006).
- Hodgetts TJ. UK statistical indifference to military casualties in Iraq (Letter). *Lancet* 2006;**367**:1393.
- Evans M. More troops are rushed out to combat threat of the Taliban. *Times* 2006; 11 July 6–7.
- Smith M. Military fears big Afghan losses. *The Sunday Times* 2006; January 1. Available at: <http://www.timesonline.co.uk/article/0,2087-1965621,00.html> (Accessed July 6, 2006).
- Smith M. Army pleads for more troops after Afghanistan firefight. *The Sunday Times* 2006; April 23. Available at: <http://www.timesonline.co.uk/article/0,,2087-2147806,00.html> (Accessed July 6, 2006).
- Operation Enduring Freedom: Coalition Fatalities. Available at: <http://www.icasualties.org/oef/Afghanistan.aspx> (Accessed September 22, 2006 and February 9, 2007).
- List of nations in the Coalition. Available at: http://en.wikipedia.org/wiki/Multinational_force_in_Iraq (Accessed September 21, 2006).
- Sengupta K. Britain hands over Afghanistan to US. *The Independent Online Edition* 2007; February 12. Available at: <http://news.independent.co.uk/world/asia/article2237663.ece> (Accessed February 12, 2007).
- Collins GW (retired US Air force lieutenant colonel and Fulbright Senior Fellow in Afghanistan). *The War in Afghanistan*. Available at: <http://www.airpower.maxwell.af.mil/airchronicles/aureview/1986/ma> (Accessed September 8, 2006).
- Grau LW, Jorgensen WA. Handling the wounded in a counter-guerrilla war: the Soviet/Soviet experience in Afghanistan and Chechnya. Available at: <http://fmso.leavenworth.army.mil/documents/handlwnd/handlwnd.htm> (Foreign Military Studies Office Publications, accessed September 8, 2006).
- Geraghty T. Oman 1958-59; 1970-76. In: *The Special Air Service, 1950 to the Gulf War. Who Dares Wins*. (ISBN 0 7515 0358 4). London: Warner Books, 2000. pp. 204.
- Norton-Taylor R. Take UK troops out of Iraq, senior military told ministers. *The Guardian* 2006; September 29 1–2.
- Bruce I. Afghan suicide bombings soar as Taliban blame outsiders. *The Herald* 2006; 28 September. (<http://www.theherald.co.uk/news/70970.html>).
- Bradt DA, Drummond CM, Richman M. Complex emergencies in Indonesia. *Prehospital Disaster Medicine* 2001;**16**:294–301.
- King R, Bird SM, Brooks SP, Hutchinson SJ, Hay G. Prior information in behavioural capture-recapture methods: demographic influences on drug injectors' propensity to be listed in data sources and their drug-related mortality. *American Journal of Epidemiology* 2005;**162**:1–10.
- Brimelow A. Afghan poppies 'could help NHS' BBC News Online 2007; 23 January. Available at: <http://news.bbc.co.uk/1/hi/health/6311929.stm>, (Accessed 12 February 2007).