

Background Quality Report for the Continuous Working Patterns (CWP) Survey

July 2015

1. Introduction

1.1 Overview

The Continuous Working Patterns (CWP) Survey is a seven day diary completed by trained, regular UK Armed Forces personnel to record the number of hours spent at work, on call, on breaks and off duty. The aim of the survey is to measure the working patterns of trained, regular UK Armed Forces personnel for a full working week - showing the average weekly hours trained, regular UK Armed Forces personnel spend at work, on call and on duty, broken down by Service, rank group and location. The report is produced annually. Each report contains information about the working patterns of trained, regular UK Armed Forces personnel over the last five years.

1.2 Background and Context

The Deputy Chief of Defence Staff, now known as Chief of Defence People (CDP) sponsors the survey under a remit from the Armed Forces Pay Review Body (AFPRB). The AFPRB provide advice to the Prime Minister and the Secretary of State for Defence on the remuneration and charges for members of the UK Armed Forces.

Defence Statistics (formerly known as Defence Analytical Services and Advice prior to April 2013) have been providing the AFPRB with information about the working patterns of trained, regular UK Armed Forces personnel since 1987/88.

Since 1987/88, a number of changes have been made to the survey. For example, prior to 1995/96 the survey excluded Officers, and prior to 1996/97, Royal Marines were excluded. The locations for the Army and RAF have changed over the years depending on where trained, regular UK Armed Forces personnel have been stationed or deployed. The analysis methodology has also changed, moving from substitution (respondents with leave days recorded in their diaries had these days substituted with means calculated using the diaries of personnel who did not record any leave), to calculating a notional week, based upon the average Monday, the average Tuesday,, the average Sunday.

1.3 Methodology and Production

Stage 1: Questionnaire Design

Single Service questionnaires are used for the Naval Service (Royal Navy and Royal Marines), the Army and RAF. All three single Service questionnaires contain a seven day diary, with each day divided into four periods of six hours. Trained, regular UK Armed Forces personnel are asked to record the number of hours they spend at work, on breaks, on call and off duty for each of these four periods. Guidance on how different activities should be recorded are provided.

As well as completing a seven day diary about their working patterns, respondents are asked to record their Service number, rank group, location, principle activity for the week, start date of the diary and information about their designated state of readiness over the seven day period. Respondents are also asked to complete two questions about leave. Responses to these two leave questions are used to inform another statistical output about the leave patterns of trained, regular UK Armed Forces personnel.

Questions are the same for all three Services, except those listed below:

- For the Naval Service, Officers are asked for their specialisation, Naval Ratings and Royal Marine Other Ranks are asked what branch they are in.
- For the Army, respondents are asked for their regiment / corps.
- For the RAF, Officers are asked for their specialisation, Airman and Airwomen are asked what trade group they are in.

CWP 2014/15 questionnaires are published as a separate document and can be found on the [CWP webpage](#)¹.

Stage 2: Sample

The target population was regular members of the UK Armed Forces who were full time, trained strength. It excluded untrained personnel, those on long term absence, Special Forces, Gurkhas, reservists and personnel ranked above OF6. There were a number of other minor exclusions arising from the practicalities of running the survey e.g. those with invalid address data. Address data for personnel in the sample were obtained from the Joint Personnel Administration System (JPA).

CWP is designed as a stratified sample survey. Stratification is by:

- Service: Naval Service (Royal Navy and Royal Marines), Army and RAF.
- Rank group: Senior Officers (OF3 to OF6), Junior Officers (OF1 to OF2), Senior Ranks/Rates (OR6 to OR9) and Junior Ranks/Rates (OR1 to OR4).
- Location:
 - Naval Service: sea and shore.
 - Army: United Kingdom, Germany, overseas Operations and elsewhere Abroad.
 - RAF: United Kingdom, overseas Operations and elsewhere Abroad.

The sample size and sampling methodology are designed to give a margin or error of +/- 0.5 hours worked for overall Service averages and +/- 1.0 hours worked for each rank group and location average.

Stage 3: Distribution

This survey is conducted using paper questionnaires. Questionnaires are packed by external contractors and dispatched via the British Forces Post Office, RAF Northolt.

For surveys prior to 2012/13, questionnaires were batched and sent to Commanding Officers who then distributed them to their staff. Reminders were also sent to Commanding Officers who had a unit response rate of less than 50%, and at least 4 non-respondents. In 2012/13, time constraints in the packing process meant that questionnaires were sent to individuals directly. Cost constraints also meant that reminders were not sent.

Due to poor response rates in the 2012/13 survey (17%), questionnaire distribution was reviewed. The decision was made batch questionnaires and send to Commanding Officers, but not send any reminders. This distribution process has been in place since the 2013/14 survey. The response rate for the 2013/14 survey was 26% - nine percentage points higher than the 2012/13 CWP survey.

For the 2014/15 survey, questionnaires were distributed to the sample in two waves, the first was sent out in September 2014 and the second in February 2015. Questionnaires were returned in postage-paid envelopes provided with the questionnaires.

For the 2014/15 survey, a total of 16,805 surveys were distributed. A response is considered valid if at least one day within the seven day diary is useable. 4,059 of the returned surveys were considered valid, which equated to a response rate of 24%, two percentage points lower than the 2013/14 survey response rate (26%).

Table 1 below shows the number of valid responses and response rates from the 2011/12 CWP survey to the 2014/15 survey, broken down by Service.

Table 1: Number of valid responses and response rates by Service between 2011/12 and 2014/15

	Number of valid responses				Response rates			
	2011/12	2012/13	2013/14	2014/15	2011/12	2012/13	2013/14	2014/15
UK Armed Forces	5,858	3,126	4,553	4,059	37%	17%	26%	24%
Naval Service	1,775	1,009	1,584	1,423	35%	16%	25%	22%
Army	2,582	1,071	1,750	1,523	36%	14%	24%	23%
RAF	1,501	1,046	1,219	1,113	43%	24%	30%	28%

Stage 4: Analysis

Many respondents returned questionnaires which included leave days or days that had to be discarded because of inconsistent or missing data. If analysis was restricted to only those questionnaires that cover a full working week, results would be based on much less data and confidence intervals would be considerably wider. Therefore, the methodology used is based upon a 'notional' week made up of the average Monday, the average Tuesday, ..., the average Sunday. By calculating the average working hours separately for each day, as much of the data as possible is used.

The sample design and the difference in non-response between Services, rank groups and locations mean that the distribution of characteristics of respondents do not reflect their distribution in the trained, regular, UK Armed Forces. This means that some types of personnel were over-represented in the data and others underrepresented in the data. The survey data are weighted by Service, rank group and location to ensure that the respondent profile matched the known population profile by these characteristics. The weights are calculated simply by:

$$\text{Weight} = \frac{\text{Population size within weighting class (p)}}{\text{Number of responses within weighting class (r)}}$$

Weighting in this way assumes missing data are missing at random (MAR) only within strata. This means we assume that within a single strata the working patterns of non-respondents are similar (on average) to the working patterns of respondents. If trained, regular UK Armed Forces personnel who did not respond to the CWP survey have different working patterns to those who did then the CWP survey results will be biased.

In order to detect any statistical differences in working patterns between the current year and the previous year, a series of z-tests were conducted with an alpha level of 5%. A statistically significant difference means there is a less than 5% probability that the difference is the result of chance alone.

If a statistical difference is found it means that the difference between years is unlikely to be the result of random variation and is therefore indicative of a genuine change in hours spent at "work", "on duty" or "on call". It does not mean that the change is necessarily large or substantively "important". It is important to note that the absence of a statistically significant difference between years does not necessarily mean that no difference is expected to exist between populations. Simply that, given the number of respondents, the detected difference is too small for us to be confident that a difference of this size could not have arisen due to chance variation in the survey process.

2. Relevance

Chief of Defence People (CDP) sponsors the survey under a remit from the Armed Forces Pay Review Body (AFPRB). The AFPRB consider information about the working patterns of Service personnel when providing advice to the Prime Minister and the Secretary of State for Defence on the remuneration and charges for members of the UK Armed Forces.

CWP provides information about the following:

- Average number of hours worked per week
- Distribution of hours worked
- Average number of hours spent on call per week
- Average number of hours spent on duty per week
- Distribution of duty hours

This information is provided for the trained, regular UK Armed Forces personnel, the Naval Service (Royal Navy and Royal Marines), the Army and RAF. Within each single Service, this information is also provided by rank group and broad location. Additional information about working unsociable and excessive hours are also provided for the trained, regular UK Armed Forces.

In order to detect differences in working patterns between the current year and the previous year, statistical comparisons are made. To identify trends, information about the working patterns of trained, regular UK Armed Forces personnel over a five year period are presented in the report.

3. Accuracy

CWP collects data about working patterns of trained, regular UK Armed Forces personnel from a stratified sample of approximately 17,000 personnel. The sample is stratified by Service (Naval Service (Royal Navy and Royal Marines), Army and RAF), rank group and location. Please see Table 2 and Table 3 below for information about these strata's.

Table 2: Stratification by rank group

Rank group	NATO Rank
Senior Officers	OF3 - OF6
Junior Officers	OF1 - OF2
Senior Ranks/Rates	OR6 - OR9
Junior Ranks/Rates	OR1 - OR4

Table 3: Stratification by location

Service	Location
Naval Service	Ship / sea
	Shore
Army	United Kingdom
	Germany
	Overseas Operations
	Elsewhere abroad
RAF	United Kingdom
	Overseas Operations
	Elsewhere abroad

The survey is designed to achieve a margin or error of +/- 0.5 hours for each Service average hours worked estimate and +/- 1.0 hours for each rank group and location average hours worked estimate. For the **average weekly hours worked**, the margins of error were as follows:

Table 4: Naval Service margins of error for average hours worked 2014/15

	Desired margin of error (in hours)	Actual margin of error (in hours)
Naval Service	+/- 0.50	+/- 0.54
Senior Officers	+/- 1.00	+/- 0.93
Junior Officers	+/- 1.00	+/- 0.90
Senior Ranks/Rates	+/- 1.00	+/- 0.90
Junior Ranks/Rates	+/- 1.00	+/- 0.87
Sea	+/- 1.00	+/- 1.20
Shore	+/- 1.00	+/- 0.56

Table 5: Army margins of error for average hours worked 2014/15

	Desired margin of error (in hours)	Actual margin of error (in hours)
Army	+/- 0.50	+/- 0.56
Senior Officers	+/- 1.00	+/- 1.02
Junior Officers	+/- 1.00	+/- 1.15
Senior Ranks	+/- 1.00	+/- 0.84
Junior Ranks	+/- 1.00	+/- 0.82
United Kingdom	+/- 1.00	+/- 0.69
Germany	+/- 1.00	+/- 0.85
Overseas Operations	+/- 1.00	+/- 1.96
Elsewhere abroad	+/- 1.00	+/- 1.02

Table 6: RAF margins of error for average hours worked 2014/15

	Desired margin of error (in hours)	Actual margin of error (in hours)
RAF	+/- 0.50	+/- 0.47
Senior Officers	+/- 1.00	+/- 1.03
Junior Officers	+/- 1.00	+/- 0.98
Senior Ranks	+/- 1.00	+/- 0.90
Junior Ranks	+/- 1.00	+/- 0.71
United Kingdom	+/- 1.00	+/- 0.51
Overseas Operations	+/- 1.00	+/- 1.84
Elsewhere abroad	+/- 1.00	+/- 1.04

For all three Services, levels of precision were lower (wider confidence intervals) for on duty and on call averages.

For the Army and RAF, the CWP survey measures the working patterns of personnel deployed on overseas Operations. On the 27th October 2014, the UK Armed Forces ceased all combat Operations in Afghanistan and withdrew the last of its combat troops. Because of this, the number of Army and RAF personnel on overseas Operations decreased whilst this survey was in field - and this has had an impact on the number of responses to the 2014/15 CWP survey.

For example, in the 2013/14 CWP survey, the number of Army personnel deployed on overseas Operations who returned a CWP questionnaire (with at least one usable days data in their diary) was 545, in the 2014/15 CWP survey, is was 164.

For the RAF, in the 2013/14 CWP survey, the number of RAF personnel deployed on overseas Operations who returned a CWP questionnaire (with at least one usable days data in their diary) was 325, in the 2014/15 CWP survey, it was 199.

Because of this, where changes in the working patterns of Army and RAF personnel on overseas Operations have been identified (between the 2013/14 and 2014/15 CWP surveys), it is unknown how much of this change (if any) is directly because of the UK Armed Forces withdrawing its combat troops from Afghanistan. Therefore, Army and RAF figures for the location category overseas Operations should be treated with caution.

It should also be noted that because of the decrease in numbers of completed CWP surveys from Army and RAF personnel on overseas Operations, the margins of error for the average weekly hours at work, on call and on duty for this group are wider than Service personnel based at any other location.

The CWP raw data is passed through a range of automatic and manual validation and editing processes. Each of the data sets from the three Services is kept separate. To ensure the results are representative of the trained, regular UK Armed Forces personnel, Defence Statistics weight responses to correct for any bias, introduced by the disproportionate stratified sample design and differing levels of response. The responses are weighted broadly by Service, Rank group and location.

Defence Statistics analyse the data using Excel. Using this software, we can apply the complex cleaning rules to the data, produce weighted estimates and corresponding standard errors. Many aspects of the CWP analysis have been automated and this helps to minimise the risk of error and improve timeliness. Where year of year comparisons are possible, 5% level z-tests are carried out. This level is used to minimise the possibility of finding false positive differences that can be expected when performing a large number of significance tests.

All statistical tables are checked by at least two Defence Statistics staff. Defence Statistics do not show any statistics where the responding group size is less than 30. This is to prevent the publication of unreliable statistical information and to prevent disclosure of information about individuals.

With non-response, there is always a risk that those who returned questionnaires have different working patterns to those that did not. We have assumed that all non-response is Missing At Random (MAR). This means we have assumed that those personnel who did not return their questionnaires have (on average) the same working patterns as those who did respond.

The CWP data has been weighted by Service, rank group and location to compensate for:

1. the design of the survey, which disproportionately samples personnel by Service, rank group and location; and
2. variations in response rates between the different Services, rank group and location.

Weighting helps to make the CWP estimates as representative as possible of the trained, regular, UK Armed Forces population. The Service / rank groups / locations that are under-represented in the dataset are given more weight so that they represent more of the people in their group who were not sampled or did not respond. Conversely, groups that are over-represented in the dataset are given less weight. Weighting assumes that all non-response is Missing At Random (MAR). This means we have assumed that all those people who did not respond within their Service / rank group / location have (on average) the same working patterns as those who did respond. If those who did not respond have different working patterns to those who did respond then the observations in this report will be biased and will not represent the working patterns of all trained regular UK Armed Forces personnel; rather, our observations would only represent the views of the responding population.

It should be noted that response rates for Naval Service personnel at sea and Army and RAF personnel who are deployed on overseas Operations are lower than personnel based at any other location. Response rates are highest for shore based Naval Service personnel and Army and RAF personnel in the United Kingdom. With regards to rank group, across all three Services response rates were highest for Senior Officers and lowest for Junior Ranks/Rates.

CWP is designed to inform users of the working patterns of our trained, regular UK Armed Forces personnel. While CWP is reported on an annual basis it should be remembered that working patterns are liable to change within the calendar year, as a result of events or the time of the year that the diary was completed (a seasonality effect).

It is important to note that there are some methodological limitations which may affect the accuracy of the results. Non-response that is directly related to individual working patterns will lead to bias within the survey results. For example, those busiest and hence working longer hours may be less likely to complete the survey.

Respondents are asked to record their working pattern for a full working week. A daily diary divided into four periods of the day is provided but respondents may complete this retrospectively, leading to recall bias. Several studies (Carstensen and Woltman.1979; Rodgers et al. 1993; Barron et al.1997) comparing company records with respondents' reports of hours worked found that individuals tended to overestimate the number of hours worked. A further study by Presser and Stinson (1998) found that employing time-use diaries was an effective means for reducing, but not eliminating response error associated with retrospective recall bias, as well as bias associated with the over reporting of socially desirable behaviour. Hence, readers should be aware that the potential remains for an upward bias in measures of time spent at 'work' or 'on call'.

4. Timeliness and Punctuality

4.1 Timeliness

Overall, CWP takes approximately 12 months to complete, from agreeing the questionnaires to publishing the report. This includes approximately:

- 4 weeks to print paper questionnaires for wave 1
- 4 weeks to pack and distribute paper questionnaires for wave 1
- 16 weeks infield for wave 1
- 4 weeks to print paper questionnaires for wave 2
- 4 weeks to pack and distribute paper questionnaires for wave 2
- 12 weeks infield for wave 2
- 2 weeks to obtain data sets from contractor
- 1 week data preparation
- 3 weeks analysis and producing tables and graphs
- 2 weeks report writing
- 2 weeks checking tables, graphs and written report

Postal questionnaires need at least ten weeks infield to ensure enough time is given for respondents to receive the questionnaires, complete them and return them before the survey closes.

It is important to note that the working patterns of Service personnel are liable to change within the calendar year, due to seasonal variations in working patterns or as a result of events or announcements. Therefore, questionnaires are sent out in two waves, the first wave is sent out in September / October, and the second wave is sent out in February. Once the data for both waves have been received from the contractor it takes Defence Statistics staff approximately 8 weeks to produce and publish the statistical report.

4.2 Punctuality

As an Official Statistic, the release date for the CWP report was pre-announced on the [MOD's Calendar of Upcoming Releases](#)² section of GOV.UK in accordance with the guidance set out in the [Code of Practice for Official Statistics](#)³.

5. Accessibility and Clarity

5.1 Accessibility

The CWP report is published on the [Statistics at MOD⁴](#) area of the GOV.UK website as a PDF document. This Background Quality Report is published as a PDF document alongside the CWP report.

5.2 Clarity

In addition to this quality report, the start of the CWP report contains a key points and trends section that summarises the main CWP findings and an introduction that provides information about the target population, the questionnaires, response rates and the statistical tests used. After the results section, there is a methodology section that contains more detailed information about the questionnaire, response rates, weighting, cleaning and analysing the data. A glossary is also provided which defines the terms used throughout the report.

Tables and graphs are used to illustrate trends in the working patterns of trained, regular, UK Armed Forces personnel over the past five years, and to highlight significant differences between the 2013/14 and the 2014/15 survey. Commentary to these graphs and tables have also been provided. Where there have been issues with the data or time series comparisons, or revisions have been made, this has been noted in the relevant section of the report.

6. Coherence and Comparability

6.1 Coherence

CWP is the definitive source of data about the working patterns of trained, regular UK Armed Forces personnel. There are no other data sources that collect the same information on working patterns with which to ensure coherence.

In February 2014, the Army's Family Federation produced a Working Hours Survey. However, neither the content nor the methodology is harmonised with CWP. Information about the working patterns of Army personnel were obtained by asking multiple choice questions such as 'in the last two years, have your soldier's working hours increased?' and 'on average, how many hours a day does your soldier work for?'. The Working Hours Survey was conducted using online questionnaires and face to face interviews and was completed by the families of Service personnel.

6.2 Comparability

CWP surveys are considered to be comparable over time. However, there have been changes to the location categories for the Army and RAF to reflect where Army and RAF personnel are stationed or deployed. Where possible, revisions have been made to figures from previous surveys to ensure comparability over time.

For example, in 2009/10, for the Army and RAF, the location category "elsewhere" was separated into "overseas Operations" and "elsewhere abroad", as population strengths for personnel based on overseas Operations was of sufficient quality to be used for weighting. To enable comparisons to be made, figures for 2007/08 and 2008/09 were revised using these new population strengths. Figures prior to 2007/08 were not revised and therefore, cannot be compared with figures from 2007/08.

In 2012/13, due to the small number of returns from personnel based in Northern Ireland, the location categories "Great Britain" and "Northern Ireland" were combined into one single location category, the "United Kingdom" for the Army and RAF. Figures for 2008/09, 2009/10, 2010/11 and 2011/12 were revised so that comparisons could be made to 2012/13. Figures prior to 2008/09 were not revised and therefore, cannot be compared with figures from 2008/09.

Since the 2012/13 CWP survey, questionnaires have been issued in two waves. Prior to the 2012/13 survey, questionnaires were issued in three or four waves. The rationale for distributing questionnaires in several waves during the year was to obtain survey estimates that were more representative of the entire year and less influenced by seasonal variations (or events / announcements etc). The reduction in the number of waves being sent out was due to cost and time constraints. It's possible that responses vary systematically throughout the year (seasonality effects). We have assumed that there is little or no seasonality effect when comparing the results of CWP surveys based on 2, 3 or 4 waves. The reader should be aware that if responses do vary systematically (depending on the period of data collection) then the change in the number of waves may impact on the comparability of responses between surveys.

7. Trade-offs between Output Quality Components

The main trade-off is between comparability over time, costs and accuracy. From 2012/13, CWP questionnaires moved from being issued in three or four waves to being issued in two waves. The move to two waves was to lower the administration cost. The rationale for distributing questionnaires in several waves during the year was to obtain survey estimates that were more representative of the entire year and less influenced by seasonal variations (or events/announcements etc). The reader should be aware that if responses do vary systematically (depending on the period of data collection) then the change in number of waves may impact on the comparability of responses between surveys as well as the accuracy of our estimates.

8. Assessment of User Needs and Perceptions

Defence Statistics work closely with the main customer and survey sponsor, Chief of Defence People (CDP) to ensure that the statistics in the CWP report are relevant to policy requirements.

9. Performance, Cost and Respondent Burden

9.1 Performance and cost effectiveness

The external contractor cost for the 2014/15 survey is approximately £32,000 (including VAT) and includes packing, distributing and data processing of the CWP questionnaires. Costs are closely monitored and Defence Statistics strive to balance quality and timeliness against costs.

9.2 Respondent burden

Response to CWP is voluntary. Participant information is provided within the questionnaire to encourage informed consent. The CWP questionnaire is currently estimated to take between fifteen and thirty minutes to complete every day. Therefore, this survey could take between one hour and forty five minutes and three hours and thirty minutes to complete over the seven day period.

10. Confidentiality, Transparency and Security

10.1 Confidentiality

Confidentiality protocols are adhered to, as set out in the Defence Statistics Disclosure and Confidentiality Policy – Identifiable Survey Data. CWP is a confidential survey rather than anonymous. The raw data is not seen by anyone outside of Defence Statistics which ensures that no person from any respondents' chain of command is able to access individual level data. Only aggregated results are provided to anyone not directly involved with the analysis. The results are only presented for groups containing at least 30 respondents.

10.2 Transparency

The production process is considered to be transparent. Each questionnaire is distributed with a participant information sheet to ensure that respondents make an informed decision before completing the survey. The CWP report is published with details of the methodology so that users are aware of potential data issues. This quality report informs users of the method, production process and quality of the output. Any significant errors identified after publication will result in revisions along with explanations as to the cause of the revisions. A list of those that require 24hr pre-release access to the statistical results are published on the [Defence Statistics pre-release access list](#)⁵ section of the GOV.UK website.

10.3 Security

All staff involved in the CWP production process adhere to the MOD and Civil Service data protection regulations. In addition all members of the survey analysis team have to follow the relevant codes of practice for the Government Statistical Services (GSS). All data is stored, accessed and analysed using the MOD's restricted network and IT system.

11. References

	Reference	Website Location
1	CWP 2014/15 questionnaires	https://www.gov.uk/government/collections/armed-forces-continuous-working-patterns-survey-index
2	MOD's Timetable of Future Releases of National and Official Statistics	https://www.gov.uk/government/statistics/announcements
3	Code of Practice for Official Statistics	http://www.statisticsauthority.gov.uk/assessment/code-of-practice/code-of-practice-for-official-statistics.pdf
4	Statistics at MOD Homepage	https://www.gov.uk/government/organisations/ministry-of-defence/about/statistics
5	Defence Statistics Pre-release Access lists	https://www.gov.uk/government/publications/defence-statistics-pre-release-access-list

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