Australian Bureau of Statistics

National Statistical Service

A guide for using statistics for

EVIDENCE BASED POLICY

ABS Cat. No. 1500.0

ABS Catalogue No. 1500.0

A guide for using statistics for

EVIDENCE BASED POLICY

CONTENTS

1. INTRODUCTION

> *'Why do statistics matter? In simple terms, they are the evidence on which policies are built. They help to identify needs, set goals and monitor progress. Without good statistics, the development process is blind: policy-makers cannot learn from their mistakes, and the public cannot hold them accountable' (World Bank, 2000: vii).*

There is an increasing emphasis from Australian and international governments on the importance of evidence based decision making in guiding policy processes (Organisation for Economic Co-operation and Development (OECD), 2005). The use of statistical information is vital for making evidence based decisions that guide the implementation of new policy, monitor existing policy, and evaluate the effectiveness of policy decisions. It is therefore essential that policy makers are equipped with the skills and ability to understand, interpret and draw appropriate conclusions from statistical information.

This guide provides an overview of how statistical information can be used to make well informed policy decisions. Throughout the guide references are made to other resources, relevant training courses and associated frameworks that provide more detail.

2. WHAT IS EVIDENCE BASED DECISION MAKING?

Governments are responsible for making policy decisions to improve the quality of life for individuals and the population. Using a scientific approach to investigate all available evidence can lead to policy decisions that are more effective in achieving desired outcomes as decisions are based on accurate and meaningful information.

Evidence based decision making requires a systematic and rational approach to researching and analysing available evidence to inform the policy making process. It 'helps people make well informed decisions about policies, programmes and projects by putting the best available evidence from research at the heart of policy development and implementation.' (Davies, 2004: 3).

Evidence based decisions can produce more effective policy decisions, and as a result, better outcomes for the community. When evidence is not used as a basis for decision making, or the evidence that is used is not an accurate reflection of the 'real' needs of the key population/s, the proposals for change are likely to produce ineffective outcomes and may even lead to negative implications for those they are seeking to benefit (Urban Institute, 2003).

As a result, the evidence based approach to decision making has gained momentum in recent years as it strives to improve the efficiency and effectiveness of policy making processes by focusing on 'what works' (Banks, 2009).

The advantages of using an evidence based approach to policy making has been discussed by many researchers (see for example Argyrous, 2009; Banks, 2009; Othman, 2005; Taylor, 2005), with some common arguments emerging to support its application throughout the policy making cycle. Using an evidence based approach to policy making can provide the following advantages:

- helps ensure that policies are responding to the real needs of the community, which in turn, can lead to better outcomes for the population in the long term
- can highlight the urgency of an issue or problem which requires immediate attention. This is important in securing funding and resources for the policy to be developed, implemented and maintained
- enables information sharing amongst other members of the public sector, in regard to what policies have or haven't worked. This can enhance the decision making process
- can reduce government expenditure which may otherwise be directed into ineffective policies or programs which could be costly and time consuming
- can produce an acceptable return on the financial investment that is allocated toward public programs by improving service delivery and outcomes for the Australian community
- ensures that decisions are made in a way that is consistent with our democratic and political processes which are characterised by transparency and accountability.

3. HOW GOOD STATISTICS CAN ENHANCE THE DECISION MAKING PROCESS

Statistics are a vital source of evidence as they provide us with clear, objective, numerical data on important aspects of Australian life including the growth and characteristics of our population, economic performance, levels of health and wellbeing and the condition of our surrounding environment.

The Australian Bureau of Statistics (ABS) plays an important role in this process by providing data 'to assist and encourage informed decision making, research and discussion within governments and the community, by leading a high quality, objective and responsive national statistical service' (ABS Mission Statement). When we are able to understand and interpret this data correctly, our ability to identify key areas which require change are enhanced, and our proposals for change are likely to respond to the 'real' needs of the Australian community. Statistics can also aid the decision making process by enabling us to establish numerical benchmarks and monitor and evaluate the progress of our policy or program. This is essential in ensuring that policies are meeting initial aims and identifying any areas which require improvement.

Statistics can be used to inform decision making throughout the different stages of the policy-making process. The following framework has been adapted from different approaches to the policy making cycle, outlined in Disability Services, Queensland, 2008; Edwards, 2004; Othman, 2005. The framework highlights the importance of using statistical information at each of the stages of the policy cycle.

STAGE 1 Identify and understand the issue

The first phase involves identifying and understanding the issue at hand. Statistics can assist policy makers to identify existing economic, social or environmental issues that need addressing. For example, statistical analysis could identify issues concerning the aging of the population or the implications of rising inflation. They are also vital for developing a better understanding of the issue by analysing trends over time, or patterns in the data.

STAGE 2 Set the agenda

Statistics provide a valuable source of evidence to support the initiation of new policy or the alteration of an existing policy or program. Once an issue has been identified, it is then necessary to analyse the extent of the issue, and determine what urgency there is for the issue to be addressed. Statistics can highlight the relevance and severity of the issue in numerical terms, and thus demonstrate the importance of developing policy or programs to address the issue as quickly as possible.

STAGE 3 Formulate policy

Once an issue has been identified and recognised as an important policy issue, it is then necessary to determine the best way to respond. This stage requires careful and rigorous statistical analysis and thorough consultation with key stake-holders to establish a clear understanding of the true extent of the problem. This will help to determine the most appropriate policy or program options to address the issue, and the best strategy for implementing these. During this stage, clearly defined aims and goals should be developed with quantifiable indicators for measuring success. Benchmarks should also be established to ensure that progress is measurable following the implementation of the policy/program.

STAGE 4 Monitor and evaluate policy

The policy process does not end once the policy/program is up and running. It is essential that the progress of a policy/program is regularly monitored and evaluated to ensure it is effective. An evaluation of the success of the policy/ program in quantifiable terms can be measured against benchmarks which were established at an earlier stage to accurately measure progress. This enables an assessment to be made as to whether the policy is meeting initial aims and objectives, as well as providing insight and identification of areas that require improvement. The process should then be repeated, by beginning the cycle again.

4. USING STATISTICS FOR MAKING EVIDENCE BASED DECISIONS

The availability of statistical information does not automatically lead to good decision making. In order to use statistics to make well informed decisions, it is necessary to be equipped with the skills and knowledge to be able to access, understand, analyse and communicate statistical information. These skills provide the basis for understanding the complex social, economic and environmental dimensions of an issue and transforming data into usable information and evidence based policy decisions.

In effect, a level of statistical literacy is required in order to understand and interpret data correctly. Statistical literacy can be measured by the following criteria, all of which are vital for the informed use of statistics.

Data awareness

- know what data is appropriate for your needs
- know what types of data are available
- access appropriate data sets – ensure the data available are 'fit for purpose'
- assess the quality of available data.

The ability to understand statistical concepts

- understand simple and more complex statistical terminology
- apply basic and more complex statistical concepts
- understand and be able to interpret graphical representations of data.

The ability to analyse, interpret and evaluate statistical information

- analyse the limitations of data sources
- identify the issues or questions you require information about, specify objectives and formulate expectations
- determine appropriate analytical techniques and undertake data analysis
- assess the results of analysis against the objectives and expectations
- review the objectives, recommence data analysis cycle as appropriate.

The ability to communicate statistical information and understandings

- using tables and graphs to present findings
- accurately and effectively write about the data.

For a more detailed explanation of what it means to be statistically literate, see 'Why Statistics Matter?' If you are interested in developing your statistical literacy skills, there are a range of resources and materials available on the Understanding Statistics pages of the ABS website www.abs.gov.au/understanding statistics.

5. DATA AWARENESS

The purpose of data is to provide information to aid decision making. Data awareness can assist users to select data sets that provide accurate answers to the questions they are attempting to answer; or one that is 'fit for purpose'. Before actively looking at data sources it is first necessary to define the data need. Being able to specify what it is you are trying to find out or what you are hoping to achieve from the outset, will help ensure you get the data you require to make well informed decisions.

The following questions can be useful in helping you define your data need:

- what is the topic or subject area you are interested in?
- who or what is your key population? (be specific about age, sex or geographical specifications)
- what are you trying to find out about this issue or group?
- are you interested in information relating to a specific time frame?

Example:

It would be inaccurate to make statements about the general health of a community by considering only hospital data as this data is not representative of the whole community. It ignores health conditions not treated in a hospital setting and is therefore, insufficient in providing all the information required to make a well informed decision.

Access appropriate data sets

Once a data need has been identified, it is then necessary to develop a better understanding of the kind of data required. There are many sources of data available, but careful consideration should be given to choosing the right data for the intended purpose. Choosing a data set that is not appropriate, can lead to inaccurate conclusions being drawn.

It is useful to be aware of the collection types that can be used to obtain quantitative data such as, censuses, samples and administrative by-product:

- a **sample survey** collects data from only a subset of the population. This subset is selected in such a way that it represents the total population as accurately as possible. The subset (or sample) is often selected randomly
- a **census** aims to collect information from everyone or everything under study. The Census of Population and Housing, conducted by the ABS, is Australia's most well known example. Others include the school census, prisoner census and agricultural census
- another common data source is **administrative by-product**. This involves production of statistics from data that have been collected for some other purpose, usually administrative. For example, the ABS uses administrative by-product data to produce information on building approvals.

ABS survey data

The ABS is Australia's official statistical organisation, and is committed to collecting and disseminating statistics to assist and encourage informed decision making, research and discussion within governments.

The ABS provides statistics free of charge via the ABS website – www.abs.gov.au – which is updated daily to enable access to a wide range of new product releases. Statistics are available on a range of topics on the ABS website, and can be found under the following themes.

Economy: Statistics are available on major economic fields that can be used by government to understand trends in the economy, identify drivers of economic growth, evaluate economic performance and for the formulation and assessment of economic policy. *Australian Economic Indicators* (cat. no. 1350.0) provides a monthly compendium of economic statistics, presenting comprehensive tables, graphs, commentaries, feature articles and technical notes.

Environment and Energy: A program of environmental statistics was implemented by the ABS in 1991 in response to an increasing demand for information investigating the relationship between social, environmental and economic statistics. A time series of environmental statistics is available to assist with informed decision making. The Environment and Energy theme page provides a portal to a range of useful data.

Industry: A broad cross-section of Australian industry data is collected on topics including agriculture, construction, transport, tourism and the services industry.

People: A range of data is available on Australia's population including, education, health, and housing to assist with monitoring the progress of society. *Australian Social Trends* (cat. no. 4102.0), released quarterly, presents statistical analysis and commentary on a wide range of current social issues.

Regional: Statistics on regional and rural areas are available for many standard data sets from the ABS. See *Topics @ a Glance* on the ABS website, for more information.

ABS census data

The Census of Population and Housing held every five years is the largest statistical operation undertaken by the ABS. The census aims to:

- measure the population
- provide certain key characteristics of everyone in Australia on census night
- better understand the dwellings in which Australian people live
- provide timely, high quality and relevant information for small geographic areas and small population groups
- complement the information provided by other ABS surveys.

Census data is provided via a range of different tools available on the Census webpage on the ABS website.

QuickStats – Provide a summary of key Census data relating to persons, families and dwellings. QuickStats cover general topics about your chosen location and include Australian data to allow comparison.

Census Tables – are designed for clients who are interested in data on a specific topic. Census Tables provide individual tables of Census data for a chosen location in excel format.

CDATA Online – allows you to create your own tables of Census data on a range of topics such as, age, education, housing, income, transport, religion, ethnicity, occupation and more. All Census geographies will be available, from a single collection district to an entire state/territory or Australia.

MapStats – provide thematically mapped Census statistics for your chosen location. The maps illustrate the distribution of selected population, ethnicity, education, family, income, labour force, and dwelling characteristics.

Community Profiles – are available as six distinct profiles of key Census characteristics relating to persons, families and dwellings, and covering most topics on the Census form for your chosen location.

TableBuilder – Census TableBuilder is an online tool which allows you to create your own tables of Census data by accessing all variables contained in the Census Output Record File for all ABS geographic areas. It is a charged subscription service.

Other sources of ABS data

ABS customised data

While published information is available free of charge on the ABS website, more complex or detailed data enquiries may be available on a fee-for-service basis through the ABS National Information and Referral Service, on 1300 135 070 (International callers +16 2 9268 4909) or visit the ABS website – www.abs.gov.au.

ABS microdata

Confidentialised Unit Record Files (CURFs) are an invaluable source of information for 'high-end' researchers and statisticians investigating a wide range of social or labour related topics. They are used to undertake data manipulations requiring individual unit record data reflecting the diversity within a population. Some typical applications include production of papers, journal articles, books, PhD theses, microsimulation, modelling and conducting detailed analyses. Data contained in a CURF is also used for producing detailed tabulations requiring data in a disaggregated form.

CURFs are released to authorised clients for approved purposes of statistical analysis and research. Find out more on the CURF Microdata Entry Page on the ABS website.

Other sources of data

Data are increasingly available from a number of other sources, and can be accessed electronically over the internet, or in publication format.

Published data may be available through libraries (public and university), government departments, community groups, newspapers, books, journals and abstracts.

Data may also be available from the following Australian and international organisations:

Australian Statistical Organisations

- Axiss Australia
- Australian Institute of Health and Welfare (AIHW)
- Australian Institute of Family Studies (AIFS)
- Office of Economic and Statistical Research (OESR)
- Bureau of Tourism Research (BTR)

- Bureau of Transport Economics (BTE)
- Commonwealth Register of Surveys of Businesses – Statistical Clearing House (SCH)
- Productivity Commission
- Reserve Bank of Australia (RBA)
- Australian Social Science Data Archive (SSDA) – Australian National University
- Australia's Economic and Financial Data according to IMF Special Data Dissemination Standard.

International Statistical Organisations

- UNData – United Nations Statistical Department – On-line data service
- International Monetary Fund (IMF) – Special Data Dissemination Standard
- OECD Statistics Portal.

Collecting your own data

If a data need cannot be met by any available data source, it may be necessary to collect data. This can be a costly and time consuming exercise depending on the size and scope of the project. Either way, to ensure the data will provide the information needed, there are a number of statistical processes that need to be undertaken. These include: identifying the target population; developing an appropriate survey and sample design; drafting and testing the collection instrument; and employing correct data processing procedures.

The Statistical Clearing House, located within the Australian Bureau of Statistics, is the clearance point for surveys of Australian businesses that are run, funded or conducted on behalf of the Australian Government. The purpose of the Statistical Clearing House is to assess the proposed survey methods and questionnaire design to ensure there is no duplication, minimise the burden on businesses and ensure surveys are fit for purpose. For more information on the Statistical Clearing House visit www.nss.gov.au or email statistical.clearing.house@abs.gov.au.

The ABS has released a *ABS Forms Design Standards Manual, 2010* (cat. no. 1530.0) which provides standards that can be used in the design and preparation of self-administered collection forms (paper and electronic). A good working knowledge of these standards should aid the development of forms that collect accurate data, ease the burden of respondents and ensure efficient processing.

The National Statistical Service (NSS) has also released a *Basic Survey Design* manual that provides an understanding of the issues involved in survey design. It includes key issues to be considered when designing surveys and outlines the advantages and disadvantages of different sample design methods.

The ABS also delivers training courses in *Basic Survey Design* and *Principles of Questionnaire Design*.

Assess the quality of available data

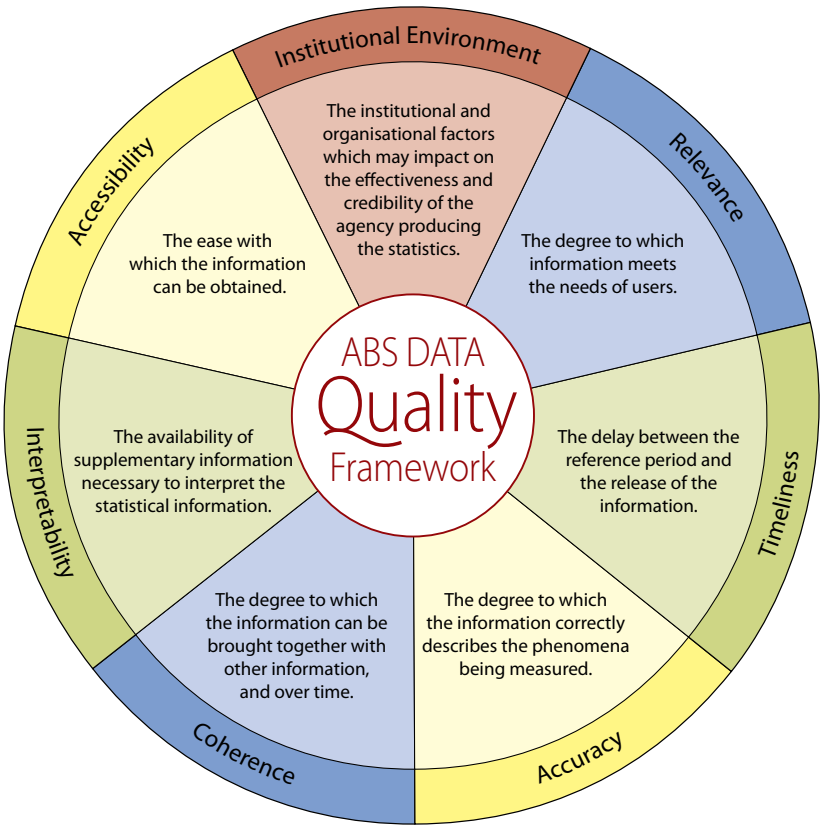
Data quality varies from one source to the next due to a wide range of factors. Quality is generally accepted as "fitness for purpose" and this implies an assessment of an output, with specific reference to its intended objectives or aims. When making an assessment of the fitness of data, it is important to keep in mind where the data has come from, how and why it was collected, and whether the data is of suitable quality for your requirements.

The ABS *Data Quality Framework, 2009* (cat.no. 1520.0) can assist in evaluating the quality of statistical collections and products (e.g. survey data, statistical tables and administrative data). It is comprised of seven dimensions of quality which are **Institutional Environment, Relevance, Timeliness, Accuracy, Coherence, Interpretability** and **Accessibility**. All seven dimensions should be used in quality assessment and reporting. However, the importance of each dimension may vary depending on the data source and the requirement of the user.

As part of its DATAfitness program the NSS has developed a tool called **Data Quality Online (DQO)**. DQO helps people use the seven dimensions of the ABS Data Quality Framework to:

- define the quality of a data item or collection of data items (prepare a quality statement)
- assess the fitness for purpose of data in the context of a data need
- identify data gaps and areas for future improvement.

Data Quality Online is located on the NSS website at http://www.nss.gov.au/dataquality/.



Dimension	Description
Institutional Environment	Institutional and organisational factors can have a significant influence on the effectiveness and credibility of the agency producing the statistics. Consideration of the institutional environment associated with a statistical product is important as it enables an assessment of the surrounding context, which may influence the validity, reliability or appropriateness of the product.
Relevance	Relevance refers to how well a statistical product or release meets your needs in terms of the concept(s) measured, and the population(s) represented. Consideration of the relevance associated with a statistical product is important as it enables us to assess whether the data is suited to our purposes.
Timeliness	Timeliness refers to the delay between the reference period (to which the data pertain) and the date at which the data become available. Timeliness is an important consideration in assessing quality, as lengthy delays between the reference period and data availability or between advertised and actual release dates can have implications for the currency or reliability of the data.
Accuracy	Accuracy refers to the degree to which the data correctly describe the phenomenon they were designed to measure. It has implications for how useful and meaningful the data will be for interpretation or further analysis.
Coherence	Coherence refers to the internal consistency of a statistical collection, product or release; as well as its comparability with other sources overtime. The use of standard concepts, classifications and target populations promote coherence as does the use of common methodology across surveys.
Interpretability	The interpretability of statistical information refers to the availability of information, or metadata, which will help you understand and utilise the data correctly. Metadata is the information that defines and gives meaning to our numbers and are available from a number of sources.
Accessibility	The accessibility of statistical information refers to the ease of finding and using your/chosen data.

6. UNDERSTANDING STATISTICAL CONCEPTS AND TERMINOLOGY

Understanding basic and more advanced statistical concepts and terminology is vital for making effective use of statistical information and for analysing and drawing conclusions from data. This includes an ability to recognise and apply basic statistical concepts such as percentages, measures of spread, ratios and probability. An understanding of more complex statistical concepts is necessary for more in-depth analysis of data. It is also necessary to be able to understand and interpret statistical information presented in tables, graphs and maps.

Qualitative and quantitative research

It is useful to have an understanding of qualitative and quantitative research techniques, and knowing which type of research is appropriate for the issue you are investigating.

Qualitative data are usually text based and can be derived from in-depth interviews, observations, analysis of written documentation or open ended questionnaires. **Qualitative research** aims to gather an in-depth understanding of human behaviour and the reasons that govern such behaviour. The discipline investigates the why and how of decision making, not just what, where and when. It allows researches to explore the thoughts, feelings, opinions and personal experiences of individuals in some detail, which can help in understanding the complexity of an issue. Smaller but focused samples may be needed rather than large random samples. Qualitative research is also highly useful in policy and evaluation research, where understanding why and how certain outcomes were achieved is as important as establishing what those outcomes were. Qualitative research can yield useful insights about program implementation such as: Were expectations reasonable? Did processes operate as expected? Were key players able to carry out their duties?

Quantitative data are numerical data that can be manipulated using mathematical procedures to produce statistics. **Quantitative research** is the systematic scientific investigation of quantitative properties, phenomena and their relationships. The objective of quantitative research is to develop and employ statistical models, theories and/or hypotheses pertaining to phenomena and relationships. The process of measurement is central to quantitative research because it provides the fundamental connection between empirical observation and statistical expression of quantitative relationships.

The following section will focus on quantitative research techniques.

Measures of central location and measures of spread

Measures of central location refers to the 'centre' of all observations in a dataset. This will give some idea of the most typical value for a particular set of observations. This centre can be expressed as a mean, median or mode.

Mean: The mean of a set of numeric observations is calculated by summing the values of all observations in a dataset and then dividing by the number of observations. It is also known as the arithmetic mean or the average.

Median: If a set of numeric observations are ordered by value, the median corresponds to the value of the middle observation in the ordered list.

Mode: In a set of data, the mode is the most frequently observed value. A set of data can have more than one mode or no modes. In many datasets, the most frequently observed value will occur around the mean and median values, but this is not necessarily the case, particularly where the distribution of the dataset is uneven.

Measures of spread indicates how values in a dataset are distributed around the central value. Some commonly used measures of spread are the range and standard deviation.

Range: The range represents the actual spread of data. It is the difference between the highest and lowest observed values. As with calculation of the median, it is helpful to order data observations to find the highest and lowest values.

Standard deviation: This measures the scatter in a group of observations. It is a calculated summary of the distance each observation in a data set is from the mean. Standard deviation gives us a good idea whether a set of observations are loosely or tightly clustered around the mean.

For more information, see *Statistical Language!, 2008* (cat. no. 1332.0.55.002) an online resource available on the ABS website. It is designed to help improve understanding of fundamental statistical concepts and equip users with the basic knowledge required for critical and informed use of data.

Reading tables, graphs and maps

Being able to understand and interpret statistical information presented in tables, graphs and maps is an essential skill for data analysis. When reading data in tables, graphs and maps it is often helpful to follow a logical process. The following steps may help you analyse and interpret data in tables, graphs and maps:

- observe the layout in order to understand how the data are arranged. Check the row and column names in a table; the x and y axis in a graph; or the key of the map to get a clear idea of the variables being displayed. Are there just numbers, or are percentages also used?
- next, scan any totals as this may assist you to get an idea of any overall trends in the data
- also, make sure you look at any additional information and footnotes as they may contain important information that can be used to assess the accuracy of the data, and/or to understand the limitations of the data
- now, have a look at the data and how it is represented. Does anything stand out? Are there any trends in the data? Are the data uniform? What relationships can you see between the data? What summary measures could you use to gain a better understanding of the data? What conclusions can be drawn?

7. ANALYSE, INTERPRET AND EVALUATE STATISTICAL INFORMATION

The process of data analysis, is the process of turning data into meaningful information. Although there are no hard and fast rules for how to analyse statistical data, ensuring that you have a methodical and systematic approach is vital to ensuring your analysis is accurate. Poor quality analysis can lead you to draw incorrect and inappropriate conclusions.

STEP 1 Identify the issues or questions you require information about, specify objectives, and formulate expectations

To ensure the analysis conducted is appropriate for addressing the underlying objective, it is vital that you understand the issue you are investigating. It is also necessary to understand the interrelationships that exist between relevant social, economic and/ or environmental factors relating to the issue. You can then formulate a set of questions which you're seeking answers and specify your objectives for analysing the data. You may like to consider:

- what is the topic or issue?
- what is the context in which to understand this issue?
- how will the analysis be used?

For example:

- the issue is the increase in students leaving school before completing year 12
- the context might include, what is the economic, social and demographic characteristics of students who are and aren't leaving school
- the analysis will throw light on the circumstances between those staying and those leaving school, and help introduce a program aimed at encouraging students to remain in schools until year 12.

It is also a good idea to formulate a set of expectations for what the data might reveal. Developing an understanding of why certain patterns might emerge in the data and what it might mean for your analysis, will help you analyse the data and draw conclusions.

STEP 2 Determine appropriate analytical techniques and undertake data analysis

Determining which analytical techniques are appropriate for investigating the data is necessary before any analysis takes place. The different analytical tools and techniques available range from simple (e.g. measures of spread) to quite complex (e.g. modelling). Keep in mind that some analytical techniques are not always appropriate for all sets of data. It is important to ensure that appropriate techniques are used in order to avoid misinterpretation or misleading results. Most of these statistical measures can be calculated automatically in spreadsheets.

The different analytical techniques can be broadly broken down into summary statistical measures and graphical analysis, however these are often used in combination.

Graphical analysis

Graphical analysis is a useful way to gain an instant picture of the distribution of the data and identifying any relationships in the data that require further investigation. Patterns in data can be more easily discernible when displayed in graphs. A range of graphical techniques can be used to present data in a pictorial format. For example, column graphs, row graphs, dot graphs and line graphs.

One way of summarising data is to produce a frequency distribution table or graph. A frequency table is a grouping of data into categories showing the number of observations in each category. These categories are referred to as classes. Once the class frequencies have been produced, the distribution can be represented graphically by column, row, dot or line graph. It may also be appropriate to plot relative frequencies to show the percentage of the population within each class interval – which enables the different sizes to be directly compared.

Summary statistical measures

Calculating summary statistics will assist you to understand the distribution of the data. These summary measures are useful for comparing information and are more precise than graphical analysis. Summary statistics assist you to develop an understanding of:

- the centre of a set of data. This is important as we often want to know what the central value is for the sample or population. The mean, median and mode are useful measures of central location. However, these measures of location can't tell the whole story about the distribution of the data. It is possible for two data sets to have the same mean but vastly different distributions. Therefore, you should also analyse the amount of variability in the data
- the variability or the spread of the data. The range, inter-quartile range, standard deviation, and variance are useful measures of variability or the spread of the data.

There are also a range of analytical techniques that can enable you to gain a deeper understanding of the data. This can involve analysing the data to determine change over time; comparison between groups; comparing like with like; and relationships between variables. Modelling techniques such as linear regression, logistic regression, and time series analysis are some ways to explore these relationships. Assistance can be sought from experienced analysts when undertaking complex statistical analysis.

STEP 3 Assess the results of analysis against the objectives and expectations

Once you have analysed, and computed some statistics from the data and feel that you have a good grasp for what the data is saying, you can then look at drawing appropriate conclusions about the data. This process can be quite complex depending on the questions you are seeking answers for and in some instances, the answers will not be clear cut. Your analysis may provide you with the basis for describing what happened but there may be many possible reasons for why this has occurred. It is important not to consider the issue in isolation, but to think about the interrelationships between social, economic and environmental factors. You may need to seek clarification through further analysis and research to ensure the conclusions you draw are accurate.

Some things to consider when drawing conclusions may be:

- what are the main results or conclusions that can be drawn?
- what other interpretations could there be?
- can the results or conclusions be supported statistically?
- do the conclusions make sense?
- do the results differ from initial expectations?

STEP 4 Review the objectives, recommence data analysis cycle as appropriate

If there are still questions unanswered, you may need to begin the data analysis cycle again.

If you're interested in learning more about data analysis, the ABS delivers a specialised training course on *'Analysing Survey Data Made Simple'*. The course covers these basic principles for analysing data as well as exploring more complex data analysis techniques.

8. COMMUNICATE STATISTICAL FINDINGS

Being able to turn data into information or communicate statistical information accurately is vital for effective decision-making. The following section provides an overview of writing statistical commentary and using tables and graphs to communicate statistical findings.

Writing about data

Writing about statistics provides an opportunity to present your analysis in a way that tells a story about the data. In effect, statistical writing can bring data to life, making it real, relevant and meaningful to the audience. When communicating statistical information it is important to ensure that the information presented is clear, concise and accurate. It is also important to provide contextual information and to draw out the main relationships, causations and trends in the data.

The following provides some useful tips to follow when writing about statistics:

- describe the context within which the topic sits
- present the complete picture to avoid misrepresentation of the data
- accurately convey the main findings clearly and concisely
- include definitions to support correct interpretations of the data
- where necessary include information on how the data was collected, compiled, processed, edited and validated
- include information on data quality and data limitations
- use plain, simple language and where possible minimise the use of jargon
- ensure information and data are accurate
- where possible avoid using data that have data quality concerns
- use tables and graphs to present and support your written commentary.

The following tips can help you ensure that statistical information is accurate, and easy to read and understand:

- avoid subjective language or descriptions (e.g. slumped to 45%)
- statements should be backed up by the data (e.g. a greater proportion of 0-14 year olds identified as Indigenous than 15-24 year olds (5.8% compared to 4.1%))
- use proportions to improve flow and ease of comprehension (e.g. nearly three quarters (73%) of females)
- use rates when comparing populations of different sizes (e.g. age specific death rate, crime rates)
- a percentage change (the relative change between two numbers) is different from a percentage point change (the absolute difference between two percentages)
- be careful of percentage change and small numbers (e.g. the region experiences a 100% increase in the number of reported crimes (from two reported incidences in 2002 to four reported incidences in 2003))
- figures should always be written as numbers (e.g. 45% instead of forty-five percent)
- comparison of large numbers can be improved by using a different scale
- rounded figures are used in text and raw data in tables.

Using tables, graphs and maps to communicate statistical findings

Whether writing a report or making a presentation, the story should be told by your evidence. A simple table, graph or map can explain a great deal, and so this type of direct evidence should be used where appropriate. However, if a particular part of your analysis represented by a table, graph or map does not add to or support your argument, it should be left out.

While representing statistical information in tables, graphs or maps can be highly effective, it is important to ensure that the information is not presented in a manner that can mislead the reader. The key to presenting effective tables, graphs or maps is to ensure they are easy to understand and clearly linked to the message. Ensure that all the necessary information required to understand what the data is showing is provided, as the table, graph or map should be able to stand alone.

Tables, graphs and maps should:

- relate directly to the argument
- support statements made in the text
- summarise relevant sections of the data analysis
- be clearly labelled.

Using tables to communicate statistical findings

An effective table does not simply present data to the audience, it supports and highlights the argument or message being presented in the text, and helps to make the meaning of that message clear, accessible, and memorable for the audience.

The following checklist may be useful when creating tables:

- label each table separately
- use a descriptive title for each table
- label every column
- provide a source if appropriate
- provide footnotes with additional information required for understanding table
- minimise memory load by removing unnecessary data and minimising decimal places
- use clustering and patterns to highlight important relationships
- use white space to effect
- order data meaningfully (e.g. rank highest to lowest)
- use a consistent format for each table.

It is also very important not to present too much data in tables. Large expanses of figures can be daunting for a reader, and can actually obscure your message.

Using graphs to communicate statistical findings

Graphs are also a useful tool for presenting data. They provide a way to visually represent and summarise complex statistical information. They are especially useful for revealing patterns and relationships that exist in the data and for showing how things may have changed over time. A well placed graph may also be useful in improving readability by breaking up large chunks of text and tables.

There are a range of different graphs used for presenting data, such as bar graphs, line graphs, pie graphs and scatter plots. It is important to use the right type of graph for presenting the information.

Effective graphs are easy to read and clearly present the key messages. Points to consider when using graphs for presentation purposes are as follows.

Title: Use a clear descriptive title to properly introduce the graph and the information it contains.

Type of graph: Choose the appropriate graph for your message, avoid using 3D graphs as they can obscure information.

Axes: Decide which variable goes on which axis, what scale is most appropriate.

Legend: If there is more than one data series displayed, always include a legend, preferably within the area of the graph, to describe them.

Labels: All relevant labels should be included, including thousands or percentages, and the name of the x-axis if required.

Colour/shading: Colours can help differentiate, however, know what is appropriate for the medium you're using.

Footnotes: These can help communicate anything unusual about the data, such as limitations in the data, or a break in the series.

Data source: Where appropriate, provide the source of data you've used for the graph.

3/4 Rules: For readability, it's generally a good rule of thumb to make the y axis 3/4 the size of the x-axis.

Using maps to communicate statistical findings

A map can often convey a message more concisely than words. Using maps to present statistical information about a geographic area can provide a quick overview of what a set of data is showing and highlight the patterns and relationships in different regions.

When presenting statistical information in a map format, ensure that you label each map correctly; include a legend; provide a scale; and include all contextual information to assist with understanding the data, and any limitations there may be.

The fundamental components that together make up a good map, include:

- prominent, clear title
- clear, self-explanatory legend
- neat, uncluttered layout
- if a thematic map, unobtrusive but useful topographic detail
- explanation of the detail, accuracy and currency of the data
- easily understood scale bar
- acknowledgement of whom produced the map.

The ABS provides a number of products for thematically mapping census statistics for a chosen location. The maps illustrate the distribution of selected population, ethnicity, education, family, income, labour force, and dwelling characteristics.

9. EVALUATE OUTCOMES OF POLICY DECISIONS

Once a policy has been implemented it is necessary to monitor and evaluate the effectiveness of the policy to determine whether it has been successful in achieving the intended outcomes. It is also important to evaluate whether services (outputs) are effectively reaching those people for whom they are intended. Statistics play a crucial role in this process. As Othman (2005) states, 'Good statistics, therefore, represent a key role in good policy making. The impact of policy can be measured with good statistics. If policy cannot be measured it is not good policy.'

Performance indicators can be used to evaluate policy, and these should be supported by timely data of good quality. *Measuring Wellbeing, 2001* (cat. no. 4160.0) provides a list of elements that effective indicators should include:

Relevant/ reflective of issue: indicators need to reflect the social, economic or environmental issues, or alternatively, the policy decisions of government.

Available as a time series: data about a single point in time can allow for comparison between population groups or geographical areas. However, when the indicator can be repeated at a later time, change in the phenomenon can be assessed.

Meaningful and sensitive to change: a successful indicator needs to closely reflect the phenomenon it is intended to measure and be realistic. It needs to relate to associated measures in a logical way and should ideally respond to changes in the real world. For example, changes in average population height will not directly or quickly reflect changing levels of nutrition.

Summary in nature: a large mass of information can be represented by a few indicator time series that bring out the main features of the issue, e.g. female to male earnings ratios. In some circumstances however, the summary nature of indicators can be misleading, e.g. a low perinatal mortality indicator for the total population can mask the higher perinatal mortality rates of Australia's Indigenous population.

Able to be disaggregated: indicators must not only reveal national averages but be capable of finer division, e.g. many social indicators vary sharply by age and sex.

Intelligible and easily interpreted: indicators need to be readily understood and not overly complex. It should be obvious exactly what an indicator is showing, and how it can be applied in practice. Life expectancy tables are often based on complex statistical and actuarial techniques, however they can be readily understood by the public.

Able to be related to other indicators: a variety of indicators can support a central measure or show relationships and interdependencies.

10. CONCLUSION

Statistics are collected on most aspects of Australian life capturing vital information about our economic performance, the well-being of our population and the condition of our environment. They help form the basis of our democracy and provide us with essential knowledge to assess the health and progress of our society.

We rely on policy and decision makers to make the best use of the information available for research, planning and informed decision-making. The use of robust statistical information is vital for the implementation of new policy, the monitoring of existing policy, and evaluating the success of policy decisions. Without statistics the decision making process would be ineffective in delivering outcomes that improve the social, economic and environmental aspects of Australian life.

What is the National Statistical Service?

The National Statistical Service (NSS) is the community of government agencies, led by the ABS as Australia's national statistical organisation, building a rich statistical picture for a better informed Australia. It aims to develop and improve a statistical system that ensures providers and users of statistics have the confidence to trust the statistics produced within it. To find out more about the NSS visit www.nss.gov.au.

11. REFERENCES

Australian Bureau of Statistics 2001, *Measuring Wellbeing: Frameworks for Australian Social Statistics*, cat. no. 4160.0, ABS, Canberra.

Australian Bureau of Statistics 2008, *Statistical Language!,* cat. no. 1332.0.55.002, ABS, Canberra.

Australian Bureau of Statistics 2009, *Data Quality Framework*, cat. no. 1520.0, ABS, Canberra.

Australian Bureau of Statistics 2010, *Australian Economic Indicators*, cat. no. 1350.0, ABS, Canberra.

Australian Bureau of Statistics 2010, *Australian Social Trends*, cat. no. 4102.0, ABS, Canberra.

Australian Bureau of Statistics 2010, *ABS Forms Design Standards Manual*, cat. no. 1530.0, ABS, Canberra.

Argyrous, G 2009, 'Evidence for Policy and Decision-Making: a practical guide', *Public Organisation Review*, Vol. 10, No. 2, pp. 191-194.

Banks, G 2009, 'Evidence-based policy-making: What is it? How do we get it?', ANZSOG/ANU Public Lecture Series, Canberra, 4 February.

Davies, PT 2004, 'Is Evidence-Based Government Possible?', Jerry Lee Lecture, presented at the 4th Annual Campbell Collaboration Colloquium, Washington DC, 19 February.

Disability Services Queensland 2008, *Evidence Based Policy Framework*, Policy Research and Evaluation Information Paper, No. 2, Queensland Government.

Edwards, M 2004, 'Social Science Research and Public Policy: Narrowing the Divide', *Academy of Social Sciences in Australia*, Occasional Paper No. 2.

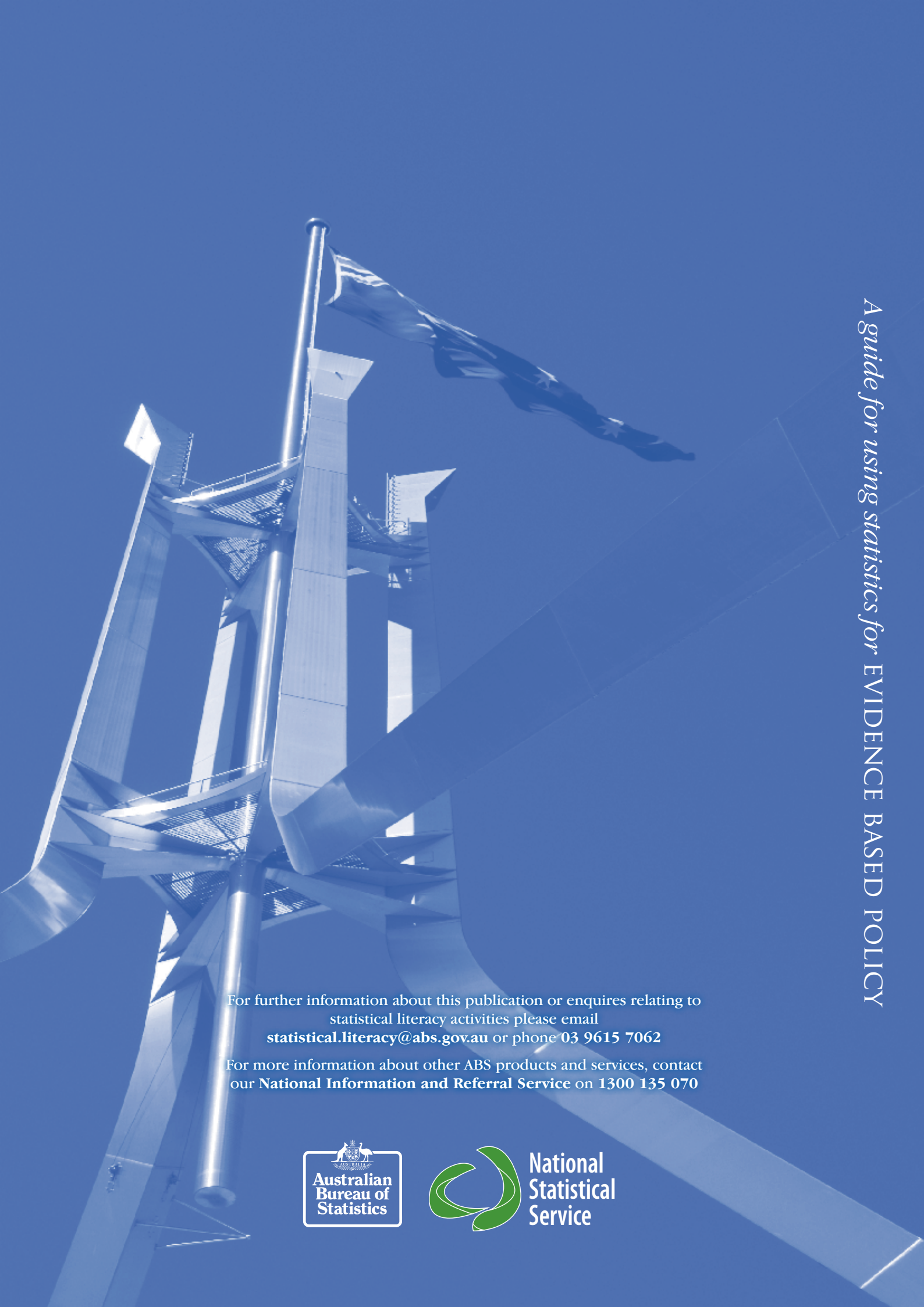
OECD 2005, *Statistics, Knowledge and Policy: Key Indicators to Inform Decision Making*, OECD Publishing.

Othman, A 2005, 'The Role of Statistics in Factual-Based Policy-Making', *Journal of the Department of Statistics, Malaysia*, Vol. 1, pp. 1-16.

Taylor, M 2005, 'Bridging research and policy: a UK perspective', *Journal of International Development*, Vol. 17, No. 6, pp. 747-757 .

Urban Institute 2003, *Beyond Ideology, Politics & Guesswork: The Case for Evidence-Based Policy,* Urban Institute Press.

World Bank 2000, *World Development Indicators*, Washington DC.



A guide for using statistics for EVIDENCE BASED POLICY

For further information about this publication or enquires relating to statistical literacy activities please email
statistical.literacy@abs.gov.au or phone **03 9615 7062**

For more information about other ABS products and services, contact our **National Information and Referral Service** on **1300 135 070**

Australian Bureau of Statistics

National Statistical Service