

## 2 METHOD

### 2.1 Introduction

The NRI-ANU Promoting Effective Public Expenditure (PEPE) project conducted an expenditure tracking and facility survey in late 2012 to assess progress in service delivery over the last decade and the effectiveness of recent expenditure reforms. 48 surveyors in eight survey teams travelled to 216 schools and 142 health clinics to conduct face-to-face interviews with teachers, health workers and community members. Surveys were conducted across eight provinces, two from each region of PNG, including some very rural and remote locations. Public officials responsible for administering funding and monitoring education and health sectors at the district and provincial levels were also surveyed. In all, there were 11 quantitative survey instruments and 1,276 interviews, making the survey one of the largest and most comprehensive completed in PNG.

The main objective of the survey was to collect nationally representative data on basic service-delivery facilities, their condition and ability to provide services, the outputs they produce, and their financing and governance. Data collection on education and health outcomes, such as measures of the cognitive ability of students or the health status of community members, was beyond the scope of the survey. Of course, these are critical, but so too are inputs and outputs. Without basic data on how many children are going to school, how many health workers are turning up to work, and what the condition of school buildings and health clinics is, it will not be possible to monitor progress in PNG's health and education sectors. These are data that every country needs.

The survey was designed to enable comparison of survey results with the Public Expenditure and Service Delivery (PESD) survey completed ten years earlier by NRI and the World Bank. While many tracking surveys have been carried out worldwide, few have been repeated. Carrying out the same survey twice greatly enhances the value of the exercise, as it enables the research not just to take a snapshot but to measure progress (or its absence). Especially in a country like PNG, where natural variability is so high, going back to the same schools and health facilities is critical for comparability. The 2002 PESD survey was conducted prior to the resource boom in PNG. It thereby provides a baseline to measure the impact of subsequent government expenditure on schools and health facilities.

This chapter begins by providing an outline of the research instruments and sampling framework used in the survey, including an overview of how the survey was conducted in challenging conditions. The basic characteristics of the education and health data collected are then presented, followed by the approach taken to data analysis.

## 2.2 Survey design and implementation

The complete process from the design of the 2012 PEPE survey to the completion of this report has been a journey of over two years. Table 2-1 provides a simplified timeline. A consultative process has been followed and the project has included a survey design workshop, and sharing of survey results at twice-yearly budget fora to seek feedback on findings from policymakers and other stakeholders. After the initial analysis, project researchers also revisited the provinces that were in the survey and met with provincial government representatives to share preliminary findings and verify results.

**Table 2-1: Survey milestones**

Survey milestones	Date completed
Survey design workshop	July 2012
Recruitment of survey team	August 2012
Pilot survey (Central Province)	September 2012
Survey team training	October 2012
Survey fieldwork	November – December 2012
Post fieldwork cleaning workshop	December 2012
Data input	January – March 2013
Data cleaning	March – May 2013
Preliminary survey analysis	June – August 2013
Re-visiting surveyed provinces	August 2013
Presentation of preliminary findings	September 2013
Further analysis and production of PEPE report	Up to October 2014

The sub-sections that follow explain how we went about the process of survey design, sample selection and data collection.

### Survey design

The 2012 survey design built on the 2002 survey to ensure direct comparisons could be made across the 10-year period. But it also made significant modifications to reflect major changes in PNG's expenditure policies and other reforms over the last decade. A key lesson from expenditure tracking surveys worldwide is that data should be collected to inform the policy debate (Filmer 2008, Sundet 2008). The literature suggests that designing surveys to track specific expenditure items of importance to policymakers is not only more manageable but often produces better policy recommendations (Gurkan et al. 2009). The PEPE surveys simplified the PESD surveys in some regards but also modified them to collect data relevant to recent major health and education reforms and initiatives: health and education financing, including the abolition of fees; medical supplies and text book distribution; and the use of constituency funding.

The first public consultation about the research project focused on survey design. The survey workshop was held in Port Moresby with more than 50 participants, including from PNG Government agencies,

the University of PNG, NGOs and other development agencies. Many of these participants had an intimate understanding of PNG's financial and service delivery systems, so were able to make useful recommendations for survey questions.

A pilot phase for testing surveys with research supervisors from ANU and NRI proved critical in developing effective survey instruments. The pilot phase consisted of approximately two weeks of fieldwork in two districts of Central Province covering close to ten schools and health clinics. Ensuring participants from the pilot phase gave detailed feedback at the end of the survey was given considerable emphasis during testing. The feedback received pointed to areas of improvement in relation to the approach, sequencing of questions and terminology used.

### Survey participants and instruments

The 2002 survey was mainly focused on education services, and had only one survey instrument on health clinics (compared to six on education). The 2012 survey took a more balanced approach, with five survey instruments on health and six on education (Table 2-2).

The surveys focused on interviewing a range of key participants at the facility, district and provincial level. Responses were recorded using paper-based survey questionnaires administered by trained surveyors. Four groups of participants were selected for interviews, and 11 participant types in all.

The most detailed interviews were with those in positions of authority in administering public funds for the provision of basic services. For schools, separate sets of questions were prepared for the Head Teacher and the Chair of the school's Board of Management (BoM). For health clinics, we prepared questions for the Officer in Charge (OIC) at the health facility.

Second, key service providers were also selected for interview. We sought to interview a Grade 5 teacher at every school, and a health worker at every clinic that had more than one worker.

Third, to capture the perspective of the community and of service users, we prepared questions for one representative from each school's Parents and Citizens (P&C) Committee and one user from each health clinic.

Fourth, and finally, to investigate supervisory arrangements, we interviewed the provincial Health and Education Managers (sometimes called Advisors). At the district level, we also interviewed District Health Managers, as well as District Standards Officers. The latter are national-government (rather than provincial-government) staff, and are responsible for the oversight and inspection of schools.

As well as soliciting the views of all of these stakeholders, the surveys also collected data on important facility characteristics, such as school

enrolments and patient visits. Other topics included textbook and drug availability, the amount, timing and sources of funding and spending practices, as well as community interaction and government oversight.

**Table 2-2: Survey instruments used for health and education sectors**

Education surveys	Health surveys
Head Teacher*	Officer in Charge of health clinic*
Grade 5 teacher*	Another health worker at the clinic
School Board of Management Chair*	
Parents and Citizens Committee member*	User of the clinic from the community
District Standards Officer	District Health Manager
Provincial Education Manager*	Provincial Health Manager

Notes: \* PESD survey conducted with the same category of respondents in 2002. The 2002 PESD also interviewed the District Education Manager (a provincial employee), whereas we interviewed the District Standards Officer (a national government employee).

## Sampling framework

The PEPE survey used the same sampling method as the PESD survey, attempting to re-visit as many of the same primary schools and health facilities as possible for direct comparability.

The 2002 PESD survey purposively selected two provinces from each of PNG's four regions,<sup>4</sup> namely:

- Southern region (Gulf, National Capital District (NCD));
- Highlands region (Enga, Eastern Highlands);
- Momase region (Sandaun, Morobe); and
- Islands region (West New Britain, East New Britain).

Within each province, three districts (with the probability of selection proportional to the number of schools in each district) were randomly selected, except for cases where provinces only had two districts.<sup>5</sup> The selected districts were: Kerema and Kikori in Gulf; Lagaip–Porgera, Wabag and Wapenamanda in Enga; Kainantu, Obura-Wonenara and Unggai-Bena in Eastern Highlands; Aitape-Lumi, Nuku and Telefomin in Sandaun; Finschafen, Huon and Tewae-Siassi in Morobe; Kandrian-Gloucester and Talasea in West New Britain; Gazelle, Kokopo and Pomio in East New Britain. Ten primary schools were selected from each district based on simple random selection.<sup>6</sup> There are no districts

4. One more developed and one less developed province was chosen from each region (World Bank and NRI 2004, Annex 1).

5. In fact, 'open electorates' were sampled. These are the constituencies from which PNG's 'open' MPs are elected (that is MPs other than provincial governors). In PNG, 'open electorates' and 'districts' are often used interchangeably, and we follow that practice. In some cases, however, one open electorate might contain more than one district.

6. Prior to the 1993 reforms, PNG had 'community' rather than 'primary' schools. In 2003, about half of the schools surveyed were still community schools. By 2012, 90 per cent of the schools surveyed were primary schools. For simplicity, we refer to all community schools as primary schools as well.

in the National Capital District, but there are three electorates (see footnote 5), and 30 schools were randomly sampled from NCD. The sample of health clinics was determined by selecting the closest health facility to each school up to a travel time of half an hour. In this way, the PESD survey sampled 214 schools (close to the target of 220) and 117 health clinics.

The 2012 PEPE survey selected exactly the same provinces and districts. Wherever possible, the same schools and health clinics were surveyed as well. To increase the number of health clinics, the allowed travel time to a health clinic from each school was increased to one hour. When schools selected under PESD were closed or inaccessible, they were replaced using simple random selection within the electorate in question. Also, when less than ten schools had been surveyed under PESD, additional schools were randomly selected to increase the sample size. There was one PESD district that was not accessible due to tribal fighting (Kandep in Enga). In this case, another district in the same province was selected.

In all, the PEPE survey visited 216 schools, including 167 of those surveyed in 2002, and 142 health facilities, including 63 of those surveyed in 2002. The distribution of all schools visited by researchers in 2012 is shown in the map at the start of this report.

### Selecting and training surveyors

Recruitment of skilled and experienced surveyors for a large survey required careful consideration. There were a total of eight survey teams covering each province, including four to eight surveyors per team, sourced through an experienced private survey firm (Tebbutt Research) operational in PNG. Each team had a team leader and an experienced NRI/ANU supervisor, who provided technical support and travelled to fieldwork sites. Surveyors (team members) were Papua New Guineans selected to ensure that they were either from the region where they were conducting the survey or at least had significant experience of that region or province. Particular attention was also paid to promoting gender balance amongst survey teams. This approach ensured survey teams were well informed and experienced in dealing with cultural sensitivities relevant to local contexts for conducting the surveys.

Research supervisors from NRI and ANU were selected based on their previous experience conducting fieldwork and implementing surveys in PNG. Extensive consultation was carried out with researchers and surveyors involved in the PESD survey in 2002.

Training survey team leaders to understand the intentions behind the survey and how to administer the instruments in the field was important to successful implementation. Particular emphasis was placed on outlining the theory and purpose of each survey. Survey instruments were explained in considerable detail to ensure that complex questions would be interpreted consistently. A series of

prompts and instructions were inserted into many survey questions to act as reminders and provide guidance.

NRI/ANU supervisors and each of the surveyors were provided with a detailed survey manual. This included a comprehensive overview of all survey instruments, including the theory and reasoning behind both sets of health and education surveys, and the importance of a consistent approach to fieldwork across provinces.

## Conducting fieldwork across PNG

Consent was gained from the PNG government through each of its layers of bureaucracy down to the school and health facility level. This included the national departments of health and education and the various provincial governments involved in the survey. It was particularly important for facility-level managers to understand that this independent research was carried out with government consent. Survey teams gained oral consent from participants prior to conducting survey interviews. In addition, information sheets written in Tok Pisin were given to participants, which, if not understood by the participant, were explained in their local language by a surveyor from the province.

Conducting survey fieldwork in a country as diverse as PNG with many remote locations presented major challenges. Survey teams travelled to locations with few communication and transport options, including very limited access to financial services. This required survey teams to be well organised and aware of safety concerns. Significant planning prior to undertaking fieldwork proved critical to monitoring progress and completing surveys in a timely manner and to a high standard. Identifying potential risks to carrying out a survey of this scale and scope in PNG was necessary before survey teams conducted fieldwork. Travelling to remote locations meant small planes and boats needed to be hired and survey teams had to walk long distances on foot. In addition, some areas of PNG are prone to violence.

Successfully carrying out the survey in the field required careful monitoring and support from the NRI and the survey firm's head offices in Port Moresby. Weekly progress reports from survey teams on the number of facilities completed, including verification from NRI/ANU supervisors, helped ensure steady progress. Combining NRI/ANU supervisors with staff from the survey firm in each province proved to be an effective and reliable way of carrying out the survey. While NRI/ANU supervisors focused on overseeing survey implementation and relationships with provincial and district officials, team-leaders and surveyors were able to focus on conducting the survey at schools and health facilities.

Survey teams learnt a lot by visiting schools and health facilities. In this report, we focus on the numbers, and use tables and graphs. But the stories that the team members brought back with them are no less



useful, and their photos often more vivid. Two examples of what we learnt follow below: from Gulf and from Enga.

### The PEPE survey in Enga – Andrew A. Mako

30 primary schools and 19 health facilities were surveyed over two months in three districts of Enga province, one of two Highlands provinces covered by the PEPE survey. Enga is mostly rural and remote, with mountainous terrain, high rainfall and poor infrastructure.

Most of the schools and health facilities we surveyed were quite isolated and far from major towns. It took hours of walking to reach them after driving on roads and crossing bridges that had severely deteriorated due to lack of maintenance. For facilities in remote parts of Enga, access to funds, including school subsidies, is difficult. Facilities have to overcome many obstacles to source materials for schools and medicines.

The level and frequency of contact or support from the district, provincial, and national government is variable. Facilities in remote parts of the province had minimal to no visits and support in many years, including compulsory school and health inspections.



Neglect of the maintenance of existing infrastructure is a major challenge for effective service delivery, including those facilities that are close to the provincial capital. Classrooms and teacher and health worker houses with leaking roofs, no desks, walls with huge holes, and broken windows and doors were common in many facilities that we visited.

The survey team met some very dedicated teachers and health workers, including retired ones, such as the individuals shown here, who volunteer to work under very trying conditions to ensure that facilities stay open. Most of these people take on extra responsibilities, such as teaching multi-grade classes.



Service delivery and development in Enga face many challenges, but seeing dedicated teachers and health workers, paid and unpaid, continue to provide services to their communities in the most difficult conditions was inspirational.

### The PEPE survey in Gulf – Colin Wiltshire

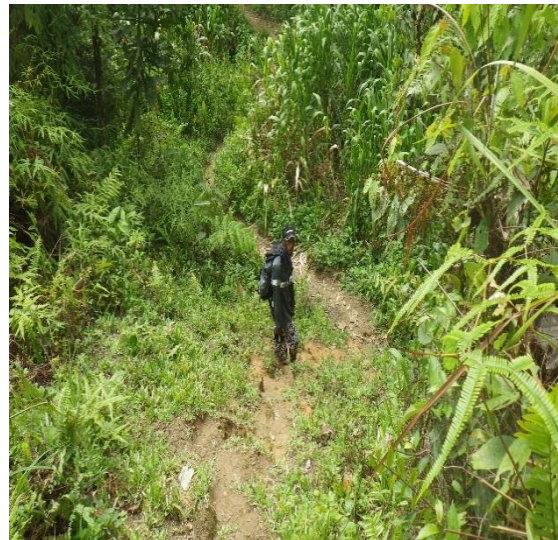
Service delivery in Gulf Province requires a ‘never say die’ attitude. The PEPE Gulf survey team



experienced first-hand the difficulties that government and church service providers face when operating in one of PNG’s most rural, remote and underdeveloped provinces.

Travelling to Kikori District, the largest of the two districts that make up Gulf Province, is very difficult when the airstrip is not operational. The only option is to hire a dinghy with an outboard motor to travel in the open sea. This takes a day and more than 100 litres of fuel, making the trip expensive, exhausting and often dangerous.

The number of schools closed since the previous survey was carried out ten years earlier was striking. On a trip to West Kikori, close to the border of Western Province, the lack of schools and health facilities to serve more remote populations was clear. In one case, provincial and district officials assured us certain schools and health clinics were operational, but when we visited we found that they had been closed for years.



Upon approaching another school in our dark blue land cruiser, which looked a lot like a police vehicle, a group of people rushed to a dinghy on the shore and set off on the sea. At the same time, disgruntled parents ran to the car yelling that the Head Teacher and BoM Chair were escaping and demanded that the team chase them down and arrest them as they had supposedly been misusing the school’s funding.

We encountered a decaying service delivery system in Gulf Province that is unable to ensure a teacher will be present to teach classes each weekday or that a health worker will have an operational clinic, drugs or lighting to treat a medical emergency at night. In place of a robust and well-regulated system were individuals determined to ensure basic services persisted despite all the problems. There were inspiring examples of retired and retrenched teachers and health workers that continue to help communities when no other services are provided.



## 2.3 The education sample

214 schools were visited in 2002 and 216 in 2012 (Table 2-3). The number of schools visited per province was also similar with one exception: in 2012, we visited six more schools in Gulf.<sup>7</sup> In both surveys there were a higher number of government schools than church schools.

There are 167 matching schools, visited in both 2002 and 2012. Over the ten years some schools had changed from church to government schools. Schools were classified by their degree of remoteness (explained below). In 2002, there were more schools where key resources were readily accessible and fewer that were very remote compared to 2012.

**Table 2-3: Schools surveyed in 2002 and 2012**

	Number of schools		Matching schools		Year established	
	2002	2012	2002	2012	2002	2012
Overall	214	216	167	167	1974	1973
East New Britain	30	29	29	29	1969	1964
West New Britain	16	16	11	11	1975	1976
Morobe	30	28	23	23	1973	1974
Sandaun	30	29	24	24	1981	1979
Eastern Highlands	29	29	23	23	1974	1972
Enga	30	30	14	14	1975	1971
Gulf	19	25	14	14	1975	1976
NCD	30	30	29	29	1967	1970
Government	115	126	90	98	1976	1975
Church	91	83	72	66	1971	1970
Readily accessible	63	56	60	49	1966	1966
Accessible	64	77	52	60	1976	1972
Remote	38	25	24	18	1978	1974
Very remote	27	56	16	39	1980	1980

There were slightly fewer church-run schools in the 2012 sample, and more government schools (Table 2-4). While still a very small percentage, in 2012 slightly more schools considered themselves neither a church nor a government school. This small 'other' category included private schools. In both surveys NCD had the highest proportion of government schools; church schools were most prevalent in East New Britain, Enga and Sandaun.

7. This was because in 2002 the Kikori district of Gulf was undersampled.

**Table 2-4: Types of schools: government, church, other**

	Government (%)		Church (%)		Other (%)	
	2002	2012	2002	2012	2002	2012
Overall	55	58	44	38	1	3
East New Britain	40	34	57	59	3	7
West New Britain	53	50	47	44	0	6
Morobe	54	75	46	25	0	0
Sandaun	37	48	63	48	0	3
Eastern Highlands	76	62	17	34	7	3
Enga	41	50	59	50	0	0
Gulf	61	60	39	32	0	8
NCD	80	83	20	17	0	0
Readily accessible	70	68	29	32	2	0
Accessible	52	57	45	38	3	5
Remote	39	60	61	40	0	0
Very remote	59	48	41	46	0	5

In each school we visited, the Head Teacher or Acting Head Teacher was interviewed. In nearly every school, we also interviewed the BoM Chair, a P&C Committee member and a Grade 5 teacher (Table 2-5). All were surveyed in 2002, except that the PESD surveyed a parent at each school rather than a P&C representative.

**Table 2-5: Primary school respondents**

	Head Teacher		BoM		P&C rep./parent		Grade 5 teacher	
	2002	2012	2002	2012	2002	2012	2002	2012
Overall	214	216	202	203	213	215	179	205
East New Britain	30	29	30	30	30	30	26	30
West New Britain	16	16	14	16	16	16	14	16
Morobe	30	28	28	28	29	28	24	27
Sandaun	30	29	30	29	30	30	24	30
Eastern Highlands	29	29	27	26	29	29	27	25
Enga	30	30	29	30	30	30	22	30
Gulf	19	25	18	20	19	26	12	19
NCD	30	30	26	24	30	26	30	28

## 2.4 The health sample

As Table 2-6 shows, the 2012 PEPE survey surveyed 142 health clinics, up from 117 in 2002, due to the decision to widen the “search range” for health clinics relative to schools (from half an hour to one hour). Only 63 of the 117 clinics surveyed in 2002 could be re-surveyed. This indicates how many health clinics have closed in PNG in the intervening decade.

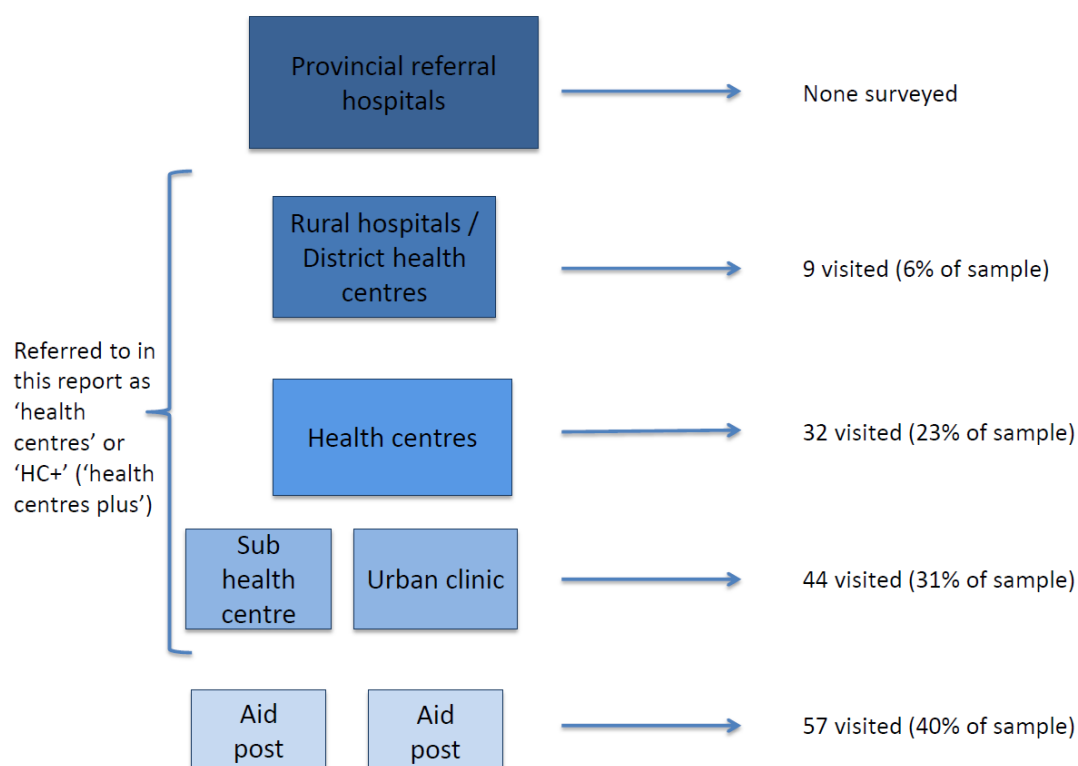
**Table 2-6: Health clinics surveyed in 2002 and 2012**

	2002	2012	Matching facilities (both)
Overall	117	142	63
East New Britain	8	21	6
West New Britain	11	14	8
Morobe	25	20	11
Sandaun	22	18	11
Eastern Highlands	9	11	7
Enga	13	19	2
Gulf	14	23	8
NCD	15	16	10
Health centres	59	85	40
Aid posts	58	57	23
Government	78	85	38
Church	35	52	23

Notes: Matching health facilities visited in Enga Province were particularly low due to tribal fighting.

PEPE survey teams visited the complete range of health facilities that make up PNG's primary health network (Chapter 1.4). Aid posts are usually the first point of contact for patients, since they are normally located in the rural and remote settings where the majority of PNG's population lives. Figure 2-1 shows that aid posts accounted for 40 per cent of the health clinics visited by survey teams. Aid posts are normally managed by a single Community Health Worker (CHW) and can only offer basic treatment. They normally refer patients requiring more comprehensive care to a health centre or sub health centre, which are often responsible for managing clusters of aid posts within a defined population of villages or towns, also known as catchment areas. A further 31 per cent of health clinics surveyed were sub-health centres or urban clinics in more heavily populated areas, and 23 percent were classified as health centres. Rural hospitals, also known as district health centres (normally located in district town centres), represented 6 per cent of the health clinics visited.

In presenting findings for this report, because they normally have only a single health worker, aid posts have been separated from the various types of health centres. 'Health centre plus' represents 60 per cent of the facilities or clinics (sub-health centres, urban clinics, health centres and rural hospitals) surveyed and aid posts represent the other 40 per cent. No provincial referral hospitals were surveyed because they represent secondary-level care in PNG's health system and operate somewhat separately from the primary health system.

**Figure 2-1: Types of health clinics surveyed (and 2012 percentage)**

Slightly more government than church-run health clinics were surveyed. As Table 2-7 shows, in 2012, 60 per cent were government-run, 37 per cent were church-run and only 2 per cent were “other”, mainly privately-run. A higher proportion of aid posts were government-run than health centres. Contrary to the case of education, a greater proportion of church-run clinics were surveyed in 2012 than 2002.

**Table 2-7: Types of health clinics: government, church, other**

	Government (%)		Church (%)		Other (%)	
	2002	2012	2002	2012	2002	2012
Overall	66	60	28	37	5	3
East New Britain	50	62	50	38	0	0
West New Britain	64	64	27	36	9	0
Morobe	72	50	28	40	0	10
Sandaun	73	67	23	33	4	0
Eastern Highlands	67	55	22	27	11	18
Enga	77	68	15	32	8	0
Gulf	36	39	64	61	0	0
NCD	80	81	20	13	0	6
Health centres	51	56	42	42	7	1
Aid posts	83	65	14	28	3	7

Three separate interviews were conducted at each clinic with the OIC of the clinic, another health worker at the same clinic (if employed and available), and a community user of the clinic (Table 2-8).

**Table 2-8: Health clinic respondents**

	OIC		Health worker	User
	2002	2012	2012	2012
Overall	117	142	82	142
East New Britain	8	21	11	21
West New Britain	11	14	6	14
Morobe	24	20	6	20
Sandaun	22	18	10	18
Eastern Highlands	9	11	8	11
Enga	13	19	11	19
Gulf	14	23	14	23
NCD	15	16	16	16
Health centre	59	85	71	85
Aid post	58	57	11	57
Government	78	85	50	85
Church	35	52	31	52

Note: Health workers and users were not surveyed in 2002. Many health clinics, especially aid posts, do not have a health worker in addition to the OIC.

## 2.5 Analysis of PEPE survey data

### Organising the data

The process of data entry, coding and cleaning of the PEPE data was time consuming due to the length and number of variables contained in the questionnaires. Data entry was performed by the survey firm. The data was entered using SPSS software, which in many cases ensured that entered data conformed to the appropriate format for each variable.

Coding of the data and data cleaning was performed using SAS software. The benefit of this approach is that any changes to the original data set are non-destructive, that is, all changes to the original data are documented and can be identified and modified at any time.

### Data weighting

Weighting of the PEPE data was necessary since roughly equal numbers of schools and health clinics were sampled in each surveyed district, but some districts had many more schools and clinics than others. District-specific weights were applied to each facility type based on a population of schools provided by NDoE and a population of health clinics provided by the Australian Department of Foreign Affairs and Trade (previously AusAID). These weights adjust for the probability of the district being selected within the province, and of the facility



being selected within the district. Separate weights were applied to health centres and aid posts.

The actual weights applied to the data were variable specific; for each variable the district-specific weights were adjusted by a factor that accounted for missing observations for that variable to ensure representativeness. For example, if one out of 10 schools sampled in a district was missing an observation for a variable then the weights for the other nine schools in that district would increase by a factor of 1.11 for that variable. A strength of this approach is that missing observations do not impact on the relative contribution of each district to the overall sample. However, as there are few facilities per district sampling variability can influence the weights.

Similar weights had earlier been developed to make the PESD school sample representative, and these were used but with the same modification to adjust them for missing variables.<sup>8</sup> Weights were never developed for the PESD health data, and the 2012 health weights were also used for the 2002 data.

With these weights, the survey results are representative of the eight provinces which were sampled. Given that one more and one less developed province was selected from each of the four regions, it is reasonable to argue that these eight provinces are representative of the nation of PNG, and that therefore the survey is nationally representative.

The results presented in the rest of the report are weighted, unless otherwise stated.

## Remoteness index

We developed a remoteness index for both 2002 and 2012 schools to identify how close schools are to key resources. To develop this index we drew upon questions (asked in 2002 and 2012) to head teachers about how far the school was in hours from the nearest bank, health clinic, trade store, provincial capital and police station. To be included in the index schools needed to have answered how far they were from each of these resources (that is, there were no missing values). Remoteness was categorised by the following rules:

- Schools that were, on average, within a half an hour of these resources were categorised as ‘readily accessible’;
- Schools that were, on average, over half an hour but less than two hours away were categorised as ‘accessible’;
- Schools that were over two hours but less than four hours away were categorised as ‘remote’;

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8. When figures for 2002 in this report differ from that those in the PESD, it may be due to this difference in weighting. In some cases, different assumptions (e.g. number of working hours in the day) may be used to define the variable. We obtained the PESD data from the World Bank website.

- Schools that were over four hours away were categorised as ‘very remote’.

The remoteness index is used when presenting findings for schools. Remoteness for health facilities is largely dependent on facility type. Aid posts are generally located in rural village settings. They are normally more remote than health centres, which are often based in towns, such as district and LLG centres.

## Sample comparisons

The substantial diversity across Papua New Guinea creates challenges in making comparisons of schools and health facilities over time. To address this problem the PEPE survey was designed as a longitudinal study; the PEPE sample included as many schools and health clinics as possible that were surveyed in the PESD survey. In this way comparisons over time would be made, as far as possible, on a like-for-like basis.

However, a number of facilities were not open at the time of the PEPE survey or could not be reached by survey teams due to dangerous conditions or deteriorated infrastructure. Table 2-9 shows the proportion of schools that were sampled in both surveys out of the total number of schools surveyed in each year (matching sample) and the share that were non-matching in each sample. A comparison of matching and non-matching health clinics in each survey is shown in Table 2-10.

**Table 2-9: Share of matching and non-matching schools across PEPE and PESD samples**

	2001/2002		2012	
	Matching (%)	Non-matching (%)	Matching (%)	Non-matching (%)
Overall	78	22	77	23
East New Britain	97	3	100	0
West New Britain	69	31	69	31
Morobe	77	23	82	18
Sandaun	80	20	83	17
Eastern Highlands	79	21	79	21
Enga	47	53	47	53
Gulf	74	26	56	44
NCD	97	3	97	3
Government	78	22	78	22
Church	79	21	80	20
Readily accessible	95	5	88	13
Accessible	81	19	78	22
Remote	63	37	72	28
Very remote	59	41	70	30

**Table 2-10: Share of matching and non-matching health clinics across PEPE and PESD samples**

	2002		2012	
	Matching (%)	Non-matching (%)	Matching (%)	Non-matching (%)
Overall	54	46	44	56
East New Britain	75	25	29	71
West New Britain	73	27	57	43
Morobe	44	56	55	45
Sandaun	50	50	61	39
Eastern Highlands	78	22	64	36
Enga	15	85	11	89
Gulf	57	43	35	65
NCD	67	33	63	38
Health centres	68	32	47	53
Aid posts	40	60	40	60
Government	49	51	45	55
Church	66	34	44	56

22 per cent of schools in the PESD survey were not resampled in the PEPE survey and 23 per cent of schools in the PEPE sample were not contained in the PESD sample. Schools in remote areas, were more likely to fall in the non-matching sample, because remote schools are harder to revisit, and perhaps are more likely to close. It is important to note that not all non-matching schools are subject to this problem. One entire district had to be replaced, and the PEPE survey increased the sample of schools from Gulf, a very remote area. Random replacement within selected districts goes some way to addressing this problem. Nevertheless, it is still possible that the replacement schools on average are less likely to be as remote as the schools in the PESD sample they replaced. This non-random nature of sample attrition can potentially lead to biased comparisons over time when they are based on the full sample of schools from each survey.

To test whether the sample comparisons were subject to this problem, the means of a number of important variables in the matching sample were compared to the means in the non-matching sample. For schools this comparison was done for all provinces other than East New Britain and NCD since the share of matching schools in these two provinces was so high. Annex Table 2-A1 shows that the difference in means across the matching and non-matching sample in the PESD survey, but note the PEPE survey, for remoteness and school size related variables (remoteness itself, as well as student enrolment, number of teacher positions, and number of teachers regularly working) were statistically different from zero. Essentially, more remote and smaller schools in the PESD survey dropped out of the PEPE survey and were replaced by average schools.

The effect of sample attrition may then upwards bias comparisons of indicators related to remoteness and school size over the decade when

they are based on the full sample (matching and non-matching) of schools. Comparisons based on just the matching sample are not subject to this specific problem since only like-for-like comparisons are made. In order to see if the sample attrition problem significantly affected the full sample results, the means of important school variables based on the full sample and the matching sample of schools were compared. Annex Table 2-A2 shows that results based on the matching or full sample were not statistically different from each other across all variables analysed.

For this reason, and since using the full sample will give us a larger sample size, and because only using matching schools will result in its own biases, all comparisons of school indicators over the decade were based on the full sample schools. Essentially, while results based on the full sample are subject to attrition bias, the effects can be considered small.

Compared to schools, the attrition rate for health clinics was high. The matching sample of health clinics represented only 54 and 44 per cent of the full sample for the PESD and PEPE surveys, respectively. Similar to schools, the mean of a number of health clinic measures were compared across matching and non-matching samples for each survey in order to identify potential problems associated with sample attrition. However, as shown in Annex Table 2-A3, the differences in these means were not statistically different to zero for all variables. This result provides no evidence of sample attrition bias for health facilities and all comparisons were based on the full sample of health clinics in both PESD and PEPE surveys.

Another potential source of bias is that the PEPE sample is likely to have under-represented new facilities. This effect is somewhat diminished through the selection of replacement facilities for those dropping out of the PESD survey, which opens up the potential for new facilities to be included in the PEPE survey. Nonetheless, this potential bias is likely to be small, as the rate of increase of schools is slow, and of health clinics negative.

In summary, both sources of bias – undersampling of new schools, and attrition bias – are modest and a small price to pay for the possibility of making reliable comparisons in a country as diverse as PNG. All comparisons in the report are based on the full PESD and PEPE samples of schools and clinics, respectively.

The PESD team visited schools and health facilities around the middle of 2002. The 2012 PEPE visits were late in the year. For questions about how many times something happened over a year – for example, how many times schools were inspected – we draw on responses comparing 2001 with 2011 or 2012. Unfortunately, 2001 data is not available for health clinics.

## 2.6 Conclusion

The PEPE survey data constitutes an important evidence base for evaluating the state of and changes in front-line service delivery in PNG. The representative nature of the sample enables the data to provide a general view of education and health service delivery across the whole country. Since the PEPE survey builds on the PESD survey, it also allows 10-year comparisons on the state of service delivery. The analysis can therefore examine not just the levels of health and education service delivery indicators, but also the change in these indicators over time.

The two surveys combined provide us with clear and detailed information on the current and changing state of infrastructure, staffing, school enrolments, number of health treatments, funding and spending at the facilities, community engagement, and formal oversight. All of these are explored in detail in the following chapters.

In PNG, there is a need for health and education officials, as well as the general public, to have information on the performance of current and previous efforts to improve schools and health facilities in the country. The design, conduct and analysis of the PEPE survey have been undertaken to meet these requirements.

## Chapter 2 Annex

**Table 2-A1: A comparison of means across matching and non-matching samples (primary schools)**

	PEPE			PESD		
	Matching	Non-matching	Difference	Matching	Non-matching	Difference
Remoteness index (hours)	3.6 (0.4)	3.7 (0.6)	-0.1 (0.8)	2.2 (0.3)	4.5 (0.9)	-2.2 (0.9)*
Revenue per student	383.2 (87)	308.5 (74)	74.7 (114)	151.3 (13)	126.9 (24)	24.4 (28)
Enrolment	305.5 (25)	310.1 (31)	-4.6 (39)	202.1 (19)	132 (16)	70.1 (25)*
Teacher positions	9.4 (0.6)	9.3 (0.9)	0.1 (1.0)	8.2 (0.5)	6.4 (0.6)	1.8 (0.8)*
Working teachers	8.5 (0.6)	8 (0.8)	0.5 (1.0)	6.9 (0.5)	3.5 (0.4)	3.4 (0.7)*
Share of permanent classrooms	0.7 (0.0)	0.7 (0.1)	0.0 (0.1)	0.6 (0.0)	0.5 (0.1)	0.1 (0.1)

Notes: Unweighted means for all schools in the PEPE and PESD surveys except those in East New Britain and NCD. Standard errors in parentheses. \* indicates that the difference in means across the matching and non-matching sample is significantly different.



**Table 2-A2: A comparison of means across matching and full samples (primary schools)**

	PESD					PEPE						
	Matching		N	Full		Difference	Matching		N	Full		Difference
	N	Mean		Mean	Mean		N	Mean		Mean	Mean	
Remoteness index (hours)	152	1.9	192	2.5	-0.5	166	3.3	214	3.3	-0.1		
		(0.3)		(0.3)	(0.4)		(0.6)		(0.5)	(0.8)		
Total revenue per student	69	167.5	89	139.7	27.8	69	320.7	188	406.3	-85.5		
		(13.1)		(9.7)	(16.3)		(19.6)		(61.0)	(64.1)		
Total student enrolment	141	215.9	182	185.6	30.3	141	314.4	207	295.4	19.0		
		(18.2)		(12.7)	(22.1)		(25.7)		(22.9)	(34.4)		
Total teacher positions	163	8.6	206	7.9	0.6	163	10.0	215	9.6	0.4		
		(0.5)		(0.4)	(0.7)		(0.2)		(0.4)	(0.5)		
Total working teachers	163	7.5	205	6.5	1.0	163	9.2	216	8.7	0.5		
		(0.5)		(0.4)	(0.7)		(0.2)		(0.5)	(0.5)		
Share of permanent classrooms	162	0.68	206	0.64	0.04	162	0.8	216	0.73	0.02		
		(0.03)		(0.03)	(0.04)		(0.03)		(0.02)	(0.03)		

Notes: Matching refers to schools contained in both the PEPE (2012) and PESD (2001/2002) samples. Full refers to the full sample of schools. Standard errors in parentheses. \* indicates the difference in means across the matching and full sample is significantly different from zero at the 5% level based on a two-tailed test.

**Table 2-A3: A comparison of means across matching and non-matching samples (health clinics)**

	2001/2002					2012						
	Matching		N	Non-matching		Difference	Matching		N	Non-matching		Difference
	N	Mean		Mean	Difference		N	Mean		Mean	Difference	
Patient visits (typical day)	63	42.7	37	56.4	-13.7	63	35.7	72	38.62	-2.9		
		(12.5)		(21.9)	(25.8)		(8.4)		(8.4)	(12.3)		
Patient visits (yesterday)	58	33.8	31	55.7	-21.9	61	24.0	70	31.79	-7.7		
		(13.2)		(37.0)	(39.9)		(7.1)		(8.8)	(11.7)		
Health worker positions	63	4.8	37	4.7	0.16	63	4.8	71	5.84	-1.1		
		(1.4)		(1.1)	(1.8)		(0.9)		(1.4)	(1.7)		
Health workers regularly working	63	4.1	37	4.0	0.02	63	3.6	71	4.46	-0.9		
		(1.3)		(0.9)	(1.6)		(0.7)		(1.2)	(1.4)		
Panadol available	63	0.88	37	0.63	0.25	63	0.71	72	0.83	-0.1		
		(0.08)		(0.12)	(0.15)		(0.12)		(0.08)	(0.15)		
TB blister packs available	63	0.56	37	0.42	0.13	63	0.31	72	0.40	-0.1		
		(0.13)		(0.13)	(0.19)		(0.10)		(0.11)	(0.15)		

Notes: Matching refers to health clinics contained in both the PEPE (2012) and PESD (2001/2002) samples. Non-matching refers to health clinics only included in one rather than both survey samples. Standard errors in parentheses. \* indicates the difference in means across the matching and non-matching sample is significantly different from zero at the 5% level based on a two-tailed test.