

Adult Admitted Patient Survey 2018

Technical Supplement

October 2019

BUREAU OF HEALTH INFORMATION

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Please note there is the potential for minor revisions of data in this report.

Please check the online version at **bhi.nsw.gov.au** for any amendments or errata.

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The conclusions in this report are those of BHI and no official endorsement by the NSW Minister for Health, the NSW Ministry of Health or any other NSW public health organisation is intended or should be inferred.

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NSW Patient Survey Program

The New South Wales (NSW) Patient Survey Program began sampling patients in NSW public health facilities from 2007. Up to mid-2012, the program was coordinated by the NSW Ministry of Health (Ministry) using questionnaires obtained under license from NRC Picker. Responsibility for the NSW Patient Survey Program was transferred from the Ministry to the Bureau of Health Information (BHI) in 2012.

BHI has a contract with Ipsos Public Affairs (Ipsos) to support data collection, while BHI conducts all survey analysis.

The aim of the survey program is to measure and report on patients' experiences in public healthcare facilities in NSW, on behalf of the Ministry and local health districts (LHDs).

This document outlines the sampling methodology, data management and analysis of the Adult Admitted Patient Survey (AAPS) 2018.

For more information on how to interpret results and statistical analysis of differences between facilities and NSW, please refer to the *Guide to Interpreting Differences* on BHI's website at bhi.nsw.gov.au/nsw_patient_survey_program.

Adult Admitted Patient Survey

AAPS was the first survey sent to patients as part of the revised NSW Patient Survey Program in 2013. It covered adult patients attending NSW public hospitals between January and December 2013.

The subsequent cycles of the survey were conducted from January to December from 2014–2018.

Changes are made to the questionnaire content between the survey years to improve navigation through the questionnaire and in response to stakeholder requests. Changes can also be informed by an analysis of information from the previous questionnaire, specifically non-response to survey questions, percentage of invalid responses to questions, floor and ceiling effects (based on the mean, standard deviation and skew of results), and correlation to other questions in the questionnaire. For changes in questionnaire content between AAPS 2017 and AAPS 2018 please see the Development Report on BHI's website.

Producing survey samples

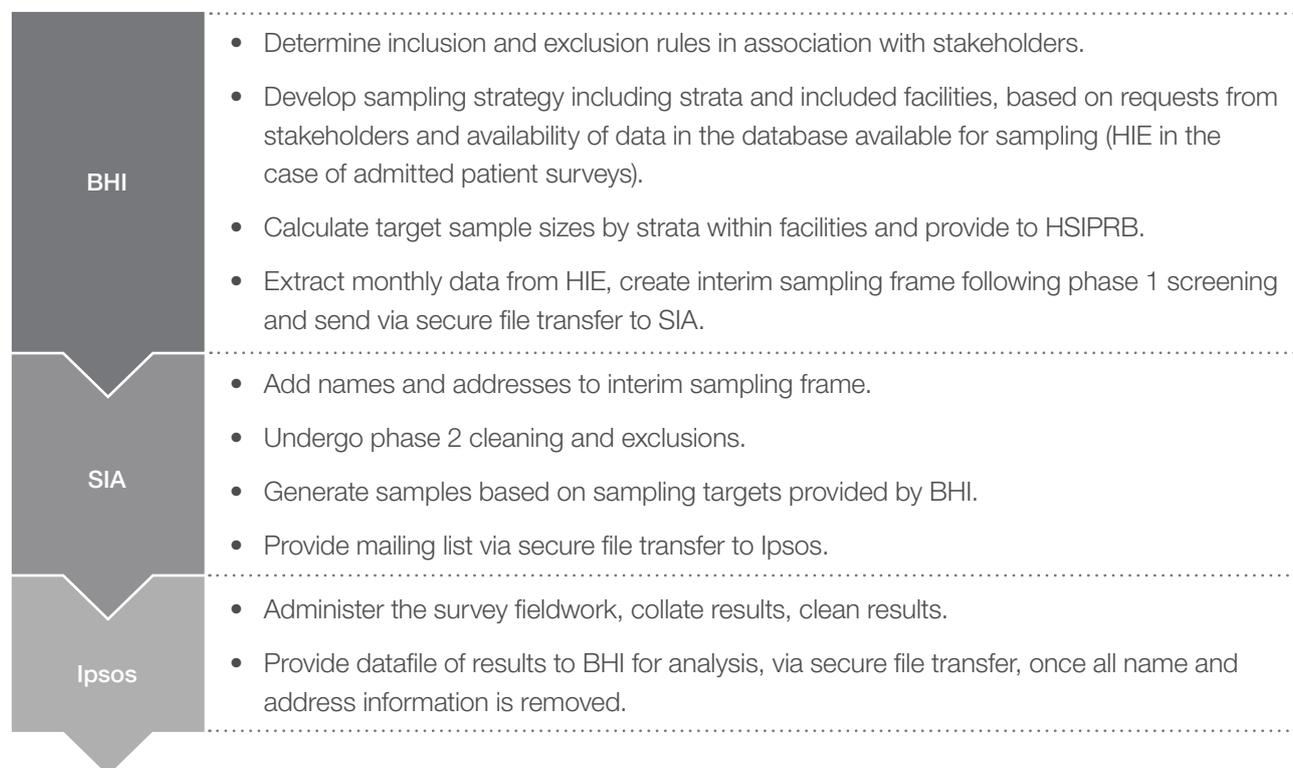
The survey program assures patients that their responses will be confidential and that staff at hospitals will not be able to determine who gave which response. BHI does this through a number of mechanisms, including:

- data suppression (results for fewer than 30 responses are suppressed)
- reporting aggregated results
- anonymisation of patient comments
- segregation of roles when constructing the survey samples (see below).

The sampling method for the survey program is a collaboration between BHI, Ipsos and the NSW Ministry of Health's Systems Information and Analytics (SIA) branch (see Figure 1). The main source of data for the sampling frame is the Health Information Exchange (HIE).

BHI has access to de-identified unit record hospital data from selected tables of the HIE database. Use of an encrypted patient number allows deduplication of patients within a hospital. For AAPS, sampling frames are defined separately for each month, with the date at discharge used to define eligible records. Sample sizes for each included hospital are calculated in advance, as defined later in this report.

Figure 1 **Organisational responsibilities in sampling and survey processing, Adult Admitted Patient Survey, 2018**



Inclusion criteria

Phase 1 screening

Admitted patient data pass through two phases of screening to create a sample frame of patients eligible to participate in the Adult Admitted Patient Survey. Phase 1 screening is conducted by BHI.

Inclusions

- Admitted patients aged 18 years and older
- Admitted to a hospital with a peer group classification of:
 - A1: Principal referral
 - A3: Ungrouped acute – tertiary referral
 - B: Major hospitals group 1
 - C1: District group 1
 - C2: District group 2.

Exclusions

- Patients who died during their hospital admission – mode of separation of 6 (Death with autopsy) or 7 (Death without autopsy)
- Patients receiving Acute and Post-Acute Care (APAC) services
- Patients who are not receiving either acute or rehabilitation care in hospital (Episode of care types 1 and 2)
- Patients who were admitted to a psychiatric unit during the hospital stay
- Patients with a personal history of self-harm (ICD-10 Z91.5) or who have intentionally self-harmed (ICD-10 X60-X84, Y87.0, Y34)
- Patients with a family history of mental or behavioural disorders (ICD-10 Z81.8) and patients who have expressed suicidal ideation (ICD-10 R45.81)
- Patient recorded with maltreatment syndromes (ICD-10 T74) in any diagnosis field, including neglect or abandonment, physical abuse,

sexual abuse, psychological abuse, other maltreatment syndromes and maltreatment syndrome, unspecified

- Patients who gave birth during their admission (ICD-10 Z37.0, Z37.2, O80-O84, or procedure codes of 90467, 90468, 90469, 90470 or 16520)
- Patients who experienced a stillbirth (ICD-10 Z37.1, Z37.3, Z37.4, Z37.6, Z37.7)
- Patients who experienced pregnancy with an abortive outcome (ICD-10 O00-O08)
- Patients admitted for a termination of pregnancy procedure (ICD-10 35643-03, 35640-03)
- Patients admitted for same-day haemodialysis – code 13100-00 in any procedure fields
- Same-day patients who stayed for less than three hours
- Same-day patients transferred to another hospital
- Patients recorded as receiving contraceptive management (ICD-10 Z30) in any diagnosis field, including general counselling and advice on contraception, surveillance of contraceptive drugs, surveillance of contraceptive device, other contraceptive management and contraceptive management, unspecified.
- Records that do not include a date of birth.

Where patients had multiple visits within the sampling month, their most recent hospital stay was retained for sampling. The questionnaire instructs the patient to respond to the survey based on their most recent admission in a particular month.

If the diagnosis code is known, then BHI excludes patients with the 'sensitive conditions' documented above. Patients with incomplete diagnosis coding are still offered the chance to participate in survey program and are not excluded. This percent was 3.9% in 2018.

Phase 2 screening

BHI provides the interim sampling frame to SIA, which adds a patient name and address information. Data then undergo a second phase of screening. This results in exclusions for administrative/logistical reasons, or where death had been recorded after discharge, but before the final sampling frame is prepared.

Exclusions

Patients meeting the following exclusion criteria are removed in this phase:

- Invalid address (including those with addresses listed as hotels, motels, nursing homes, community services, Mathew Talbot Hostel, 100 William Street, army quarters, jails, unknown)
- Invalid name (including twin, baby of)
- Invalid date of birth
- On the 'do not contact' list
- Sampled in the previous six months for any BHI patient survey currently underway
- Recorded as deceased according to the NSW Birth Deaths and Marriages Registry and/or Agency Performance and Data Collection, prior to the sample being provided to Ipsos.

The data following these exclusions are defined by BHI as the final sampling frame.

Drawing the sample

Survey design

A stratified sample design was applied, with each hospital defined as a stratum. Within each hospital, patients were further stratified by the following variables:

- Age – 18–49 or 50 years and over, based on the age variable
- Stay type – same-day or overnight admission, based on the start and end times of the last hospital stay in the month.

Simple random sampling without replacement was applied within each stratum to create a final sample of patients who were mailed a survey.

Calculation of sample sizes and reporting frequency

Monthly sample sizes were determined prior to the commencement of the survey year. These calculations were based on data extracted from the HIE for the previous 12-month period, using the inclusion and exclusion criteria described in section of this document, Phase 1 screening.

Hospitals in peer groups A1, A2 and B were sampled on the basis of quarterly reporting. The remaining hospitals were sampled on the basis of semi-annual reporting. The reporting frequency for each hospital included in the survey is shown later in the report (Table 2).

The following equation was used to estimate the sample size at the hospital level:

$$S_i = \frac{\chi^2 N_i P(1-P)}{d^2(N_i-1) + \chi^2 P(1-P)}$$

Where:

S_i = desired sample size per reporting period for hospital i

χ^2 = tabulated value of chi-squared with one degree of freedom at 5% level of significance (3.841)

N_i = patient population per reporting period for hospital i

P = expected proportion giving positive response to the question on satisfaction with overall care (0.8), based on previous levels of response to patient surveys

d = degree of accuracy of the 95% confidence interval expressed as a proportion (± 0.07).

Sample sizes were allocated proportionately across each stratum of age group and stay type.

Sample sizes were inflated to account for expected response rates to ensure a sufficient number of patients participated from each hospital. For this survey, the expected response rates were:

- 18–49 years: 21% (same day), 19% (overnight)
- 50+ years: 56% (same day), 52% (overnight).

Monthly survey targets were provided to SIA after dividing the inflated sample size evenly by 12, and applying a minimum monthly sample size of at least six to each sampling stratum. For each month of sampling, SIA randomly selected patients within each hospital and stratum, with the aim of achieving the targets provided by BHI.

Note: Royal Prince Alfred Hospital Institute of Rheumatology & Orthopaedics is pooled with the Royal Prince Alfred Hospital for reporting. The targets for each stratum in these combined hospitals are proportionately allocated across eight strata made up of two hospitals, by two stay-type and two age strata.

Data collection and analysis

Data collection

Respondents are asked to return (paper-based) or submit (electronically) their completed questionnaire to Ipsos. Paper format questionnaires are scanned for fixed response options and manually entered in the case of free text fields. All text entry fields are checked for potential identifiers (e.g. names of patients and doctors, telephone numbers) and any that are found are replaced with 'XXXX'.

Following this, each record is checked for any errors in completion. Reasonable adjustments are made, such as removing responses where the respondent has not correctly followed questionnaire instructions or where the respondent has provided multiple answers to a single response question.

At the end of this process, Ipsos transfers data securely to BHI's servers, all of which are password protected with limited staff access.

At no stage does BHI, which analyses the data, have access to the names and contact details of respondents. This ensures responses remain confidential and identifying data can never be publicly released.

Data analysis

For AAPS 2018, there were 59,113 questionnaires mailed and 17,805 responses.

Completeness of questionnaires

Survey completeness is a measure of how many questions each respondent answered as a proportion of all questions in the questionnaire. The completeness of responses was high overall, with respondents answering, on average, 78 out of the 97 of the non-text questions.

Weighted response rate

Younger patients were oversampled to ensure greater representation of these patients in the respondent profile. As a result, the distribution of patients in the sample does not necessarily match the distribution of patients in the population. Therefore, response rates were weighted to ensure that the overall survey response rate reflects that which would be observed if patients were sampled in proportion to the patient mix. For more details about the calculation of weighted response rates, refer to the *Technical Supplement – Adult Admitted Patient Survey 2014*.

The overall weighted response rate was 37%. At the LHD level, this ranged from 25% to 46%. At the hospital level, this ranged from 21% to 56%. Response rates at LHD and hospital level are provided in Tables 1 and 2, respectively, later in the document.

Weighting of data

Responses from the survey were weighted to optimise the degree to which results from respondents are representative of the experiences and outcomes of the overall patient population. At the LHD and NSW level, weights also ensure that the different sampling proportions used at the hospital level are accounted for, so that LHD results are not unduly influenced by small hospitals that had larger sampling proportions.

For each reporting period, responses were weighted to match the population by stay type (same-day or overnight) and age (18–49 or 50+ years) within each hospital. Weights were calculated as follows.

An initial weight was calculated for respondents in each stratum using Equation 2:

$$w_i = \frac{N_i}{n_i}$$

where:

N_i = total number of patients eligible for the survey in the i^{th} stratum

n_i = number of respondents in the i^{th} stratum.

If the stratum cell size was five or fewer, cells were aggregated prior to weighting, provided that the aggregation did not increase the weights allocated to the cell with the small sample size.

Each quarter of data was weighted separately. Hospitals where sample size was based on semi-annual reporting were aggregated within an LHD in order to undertake quarterly weighting. The quarterly weights are used for quarterly or semi-annual reporting. Once the four quarters of data were available, they were aggregated and the weights for hospitals sampled on the basis of semi-annual reporting were recalculated at the hospital level. The adjusted (annual) weights are used for the reporting of results based on the full 12 months of data.

Assessment of weights

Weights were assessed to ensure that undue emphasis was not applied to individual responses. The ratio of the maximum to median weight at the hospital level was reviewed. For this survey, this ranged from 1.3 to 4.4.

The design effect (DEFF) estimates the increase in the variance of estimates due to the complex sample design over that of a simple random sample. It is estimated as $(1 + \text{coefficient of variance (weights)})^2$. Sample sizes, weighted response rates and DEFFs are shown in Table 1 (by LHD and NSW) and Table 2 (by hospital).

A DEFF of two indicates that the variance of estimates will be double the sample variance that would have been obtained if simple random sampling had been done. Generally speaking, LHDs with the largest DEFFs are those that have the greatest range in patient volumes across hospitals within the LHD.

The standard errors at the LHD level are fairly small because of the sample sizes at that level. Therefore the increase in standard errors caused by the survey design (and leading to a larger DEFF at LHD level) is more than offset by the fact that each hospital that is sampled has sufficient sample size to allow hospital-level reporting. In addition, the estimates at the LHD level have appropriate distribution of respondents between large and small hospitals.

Table 1 Sample size, response rates and design effects (DEFF), by LHD and overall, AAPS, January to December 2018

LHD	Surveys mailed	Survey responses	Weighted response rate (%)	DEFF
Central Coast	2,043	663	41	1.1
Far West	904	235	32	1.1
Hunter New England	9,759	3,191	40	1.6
Illawarra Shoalhaven	2,813	976	41	1.6
Mid North Coast	2,774	1,074	46	1.2
Murrumbidgee	2,457	747	37	1.6
Nepean Blue Mountains	2,675	767	34	1.7
Northern NSW	4,664	1,604	42	1.5
Northern Sydney	4,512	1,325	35	1.5
South Eastern Sydney	5,706	1,686	37	1.5
South Western Sydney	4,964	1,216	30	1.3
Southern NSW	2,931	1,040	44	1.3
St Vincent's Health Network	1,124	296	33	1.0
Sydney	3,597	924	30	1.1
Western NSW	3,945	1,203	36	1.3
Western Sydney	4,245	858	25	1.3
NSW	59,113	17,805	37	1.7

Table 2 Sample size, response rates and design effects (DEFF), by hospital, AAPS, January to December 2018

Hospital	Reporting period	Surveys mailed	Survey responses	Weighted response rate (%)	DEFF
Armidale	Semi-annual	501	176	43	1.0
Auburn	Quarterly	1,266	224	21	1.1
Ballina	Semi-annual	427	172	48	1.0
Bankstown-Lidcombe	Quarterly	1,058	261	30	1.1
Batemans Bay	Semi-annual	429	177	51	1.1
Bathurst	Semi-annual	537	169	39	1.1
Belmont	Semi-annual	548	191	44	1.0
Blacktown	Quarterly	1,214	251	27	1.1
Blue Mountains	Semi-annual	498	166	38	1.0
Bowral	Semi-annual	466	178	45	1.1
Broken Hill	Quarterly	904	235	32	1.1
Byron Central	Semi-annual	408	113	34	1.0
Calvary Mater Newcastle	Quarterly	951	314	40	1.0
Campbelltown	Quarterly	1,149	258	29	1.1
Canterbury	Quarterly	1,145	238	25	1.1
Casino	Semi-annual	416	152	44	1.1
Cessnock	Semi-annual	474	169	45	1.1
Coffs Harbour	Quarterly	994	364	45	1.0
Concord	Quarterly	1,037	264	30	1.1
Cooma	Semi-annual	462	160	41	1.0
Cowra	Semi-annual	429	145	39	1.0
Deniliquin	Semi-annual	421	151	43	1.1
Dubbo	Quarterly	1,096	280	32	1.1
Fairfield	Quarterly	1,167	269	27	1.1
Gosford	Quarterly	1,083	336	40	1.1
Goulburn	Semi-annual	487	150	39	1.0
Grafton	Semi-annual	497	166	43	1.0
Griffith	Semi-annual	525	134	31	1.1
Gunnedah	Semi-annual	400	126	37	1.2
Hawkesbury	Semi-annual	549	168	36	1.0
Hornsby Ku-ring-gai	Quarterly	1,075	332	36	1.0
Inverell	Semi-annual	437	147	41	1.0
John Hunter	Quarterly	1,138	344	39	1.0
Kempsey	Semi-annual	429	164	44	1.1
Kurri Kurri	Semi-annual	418	206	56	1.0
Forbes	Semi-annual	402	129	40	1.1
Lismore	Quarterly	1,020	336	41	1.0
Lithgow	Semi-annual	425	159	43	1.0
Liverpool	Quarterly	1,124	250	26	1.1

Hospital	Reporting period	Surveys mailed	Survey responses	Weighted response rate (%)	DEFF
Macksville	Semi-annual	416	170	48	1.1
Maclean	Semi-annual	407	170	49	1.0
Maitland	Quarterly	1,084	332	38	1.0
Manly	Quarterly	895	231	32	1.1
Manning	Quarterly	915	344	46	1.1
Milton Ulladulla	Semi-annual	355	158	49	1.0
Mona Vale	Quarterly	898	284	37	1.1
Moree	Semi-annual	448	104	29	1.1
Moruya	Semi-annual	514	192	44	1.1
Mount Druitt	Semi-annual	561	126	25	1.1
Mudgee	Semi-annual	454	150	37	1.0
Murwillumbah	Semi-annual	439	177	47	1.0
Muswellbrook	Semi-annual	497	147	39	1.0
Narrabri	Semi-annual	382	123	40	1.1
Nepean	Quarterly	1,203	274	30	1.1
Orange	Quarterly	1027	330	39	1.0
Port Macquarie	Quarterly	935	376	49	1.0
Prince of Wales	Quarterly	1,096	307	34	1.0
Queanbeyan	Semi-annual	574	199	42	1.1
Royal Hospital for Women	Quarterly	1,534	418	31	1.1
Royal North Shore	Quarterly	1,132	318	35	1.0
Royal Prince Alfred	Quarterly	1,415	422	34	1.0
Ryde	Semi-annual	512	160	36	1.1
Shellharbour	Semi-annual	462	188	47	1.1
Shoalhaven	Quarterly	948	311	41	1.0
Singleton	Semi-annual	520	148	37	1.0
South East Regional	Semi-annual	465	162	43	1.0
St George	Quarterly	1,061	302	33	1.0
St Vincent's	Quarterly	1,124	296	33	1.0
Sutherland	Quarterly	984	342	41	1.1
Sydney and Sydney Eye	Quarterly	1,031	317	38	1.0
Tamworth	Quarterly	1,046	320	39	1.0
The Tweed	Quarterly	1,050	318	39	1.0
Wagga Wagga	Quarterly	1,071	298	35	1.1
Westmead	Quarterly	1,204	257	25	1.1
Wollongong	Quarterly	1,048	319	38	1.0
Wyong	Quarterly	960	327	42	1.0
Young	Semi-annual	440	164	44	1.0

Comparing weighted and unweighted patient characteristics

One of the aims of sample weights is to ensure that, after weighting, the characteristics of the respondents closely reflect the characteristics of the patient population.

Table 3 (page 12) shows the demographic characteristics of respondents against the patient population. The four columns denote:

1. percentage of patient population – the patient population prior to the phase 2 screening process
2. percentage of eligible population – final sampling frame from which the sample is drawn. Limited demographic variables are available at this level
3. percentage of respondents – respondents to survey, not adjusted for unequal sampling
4. percentage of respondents (weighted) – respondents to survey, adjusted by weighting to be representative of the patient population.

Table 3 Demographic characteristics of patient and respondents, AAPS, January to December 2018

Demographic variable	Sub-group	% of patient population	% of eligible population	% of respondents (unweighted)	% of respondents (weighted)
LHD	Central Coast	5	5	4	5
	Far West	0	0	1	0
	Hunter New England	12	12	18	12
	Illawarra Shoalhaven	5	5	5	5
	Mid North Coast	4	4	6	4
	Murrumbidgee	3	3	4	3
	Nepean Blue Mountains	5	5	4	5
	Northern NSW	6	6	9	6
	Northern Sydney	9	9	7	9
	South Eastern Sydney	10	10	9	10
	South Western Sydney	12	12	7	12
	Southern NSW	3	3	6	3
	St Vincent's Health Network	2	2	2	2
	Sydney	9	9	5	9
	Western NSW	4	4	7	4
Western Sydney	10	10	5	10	
Peer group	A1	47	47	22	47
	A3	3	3	6	3
	B	35	35	36	35
	C1	9	9	13	9
	C2	6	6	23	6
Age stratum	18-49	35	33	29	32
	50+	65	67	71	68
Stay type	Overnight	68	65	63	65
	Same day	32	35	37	35
Aboriginal status	Not Aboriginal	96	.	98	98
	Aboriginal and/or Torres Strait Islander	4	.	2	2
Sex	Male	46	.	44	46
	Female	54	.	56	54

Reporting

Confidentiality

BHI does not receive any confidential patient information and only publishes aggregated data and statistics. Any question must include a minimum of 30 respondents at reporting level (hospital or LHD or NSW) for it to be reported to ensure there are enough respondents for reliable estimates to be calculated. This also ensures that confidentiality and privacy are protected.

Statistical analysis

Data were analysed for the period from January to December 2018 combined, as well as by quarter. Analysis was undertaken in SAS V9.4 using the SURVEYFREQ procedure, using a finite population correction factor and the Clopper Pearson adjustment for confidence interval calculation. Hospital, age group and stay type were included as strata variables. Results were weighted for all questions, with the exception of questions related to socio-demographic characteristics and self-reported health.

The result (percentage) for each response option in the questionnaire is determined using the following method:

Numerator – the (weighted) number of survey respondents who selected a specific response option to a certain question, minus exclusions.

Denominator – the (weighted) number of survey respondents who selected any of the response options to a certain question, minus exclusions.

Calculation – the numerator/denominator x 100.

Results are reported at the quarterly level for the period from January 2013 to December 2018, where questions were comparable across years. For these quarterly results, only questions related to hospital performance are reported in BHI's interactive data portal, **Healthcare Observer**.

Unless otherwise specified, missing responses and those who responded 'don't know/can't remember' to questions were excluded from analysis. The exception is when the 'don't know/can't remember' response was used for a question that asked about a third party (e.g. if family had enough opportunity to talk to the doctor) or when the percentage responding with this option was more than 10%.

When reporting on questions that are used to filter respondents through the questionnaire rather than asking about hospital performance, the 'don't know/can't remember' option and missing responses were also reported. Appendix 1 presents the rates of missing or 'don't know' responses for AAPS 2018.

In some cases, the results from several responses are combined to form a 'derived measure'. For information about how these measures were developed, please see Appendix 2.

Interpret with caution

All sample surveys are subject to sampling error (i.e. the difference between results based on surveying a selection of respondents, and the results if all people who received care were surveyed). The true result is expected to fall within the 95% confidence interval 19 times out of 20.

Where the confidence interval was wider than 20 percentage points, results are noted with a “**” to indicate 'interpret with caution'. In addition, percentages of 0 or 100, which do not have confidence intervals, are also noted as 'interpret with caution' where the number of respondents is less than 200.

Results should be interpreted with caution if the response rate is lower than 25%. For the AAPS 2018, the response rate for Auburn Hospital was 21%. This was the only hospital with a response rate lower than 25%.

Note: Only for hospitals that were sampled on the basis of quarterly reporting and where at least six quarters of unsuppressed results were available.

Reporting by population group

Results were generated for each question in the survey at the NSW, LHD and hospital level. In addition, results were reported for the following

groups, levels and at the indicated reporting frequency outlined in Table 4.

Table 4 Levels of reporting, AAPS, January to December 2018

Grouping	Reporting frequency	NSW	Peer group	LHD	Hospital
All patients	Annually	✓	✓	✓	✓
	Quarterly	✓	✓	✓	✓
Age group: self-reported – administrative data used where question on year of birth was missing or invalid		✓	✓	✓	✓
Sex: self-reported – administrative data used where question on sex was missing or invalid		✓	✓	✓	✓
Education: response ‘Still at secondary school’ was combined with ‘Less than Year 12’		✓	✓	✓	✓
Main language spoken at home		✓	✓	✓	✓
Long-standing health conditions	Annually	✓	✓	✓	✓
Self-reported health status		✓	✓	✓	✓
Quintile of disadvantage: based on the Australian Bureau of Statistics Index of Relative Socio-demographic Disadvantage		✓	✓	✓	✓
Country of birth: from administrative data		✓	✓	✓	✓
Rurality of patient residence: based on ARIA+* category of postcode of respondent residence – outer regional, remote and very remote combined		✓	✓	✓	✓

* Accessibility/Remoteness Index of Australia is the standard Australian Bureau of Statistics measure of remoteness. For more information refer to abs.gov.au/websitedbs/d3310114.nsf/home/remoteness+structure

Standardised comparisons

Until now, BHI's approach to comparisons between hospitals and NSW-level results in BHI reports relied on a basic method (overlapping confidence intervals) to determine if the experiences reported for each hospital differed significantly from the NSW result. While this method is commonly used to highlight differences in survey results, it cannot take into account differences in the mix of patient characteristics across hospitals.

To enable fairer comparisons across hospitals and as part of the implementation of standardised comparisons, BHI reporting now takes the mix of patient characteristics at each hospital (including age, sex, education level, and language) into account. Therefore, when a hospital is flagged as having a significantly higher or lower result than NSW, this is more likely to reflect differences in patient experiences and less likely to reflect differences in the hospital's patient mix.

The difference between the former and new methods might not be entirely due to adjustment for patient characteristics. It could also be partly due to the different method used for identifying the outliers (i.e. overlapping confidence intervals vs. p-values).

Methodology

For performance-related survey questions, the percentage of respondents who selected the most positive response category was compared between each hospital and NSW. For example, one question asked patients: Were you given enough privacy when being examined or treated? It had the following response options:

- Yes, always
- Yes, sometimes
- No

In this case, the most positive response is "Yes, always" (i.e. the event), and the other two responses are grouped together for the analyses (i.e. the reference group).

Logistic regression mixed models were used for all analyses, with hospitals as random intercept terms. Patient characteristics were fixed covariates in the model.

For each performance question in the survey, the most positive response option was treated as the 'event' and the other response options were grouped to create a binary dependent variable.

The general formula for the logistic mixed model is:

$$g(E(Y_i)) = \beta X_i + b_i Z_i$$
$$b_i \sim N(0; D)$$

where:

- the link function $g(\cdot)$ is the logistic function
 $g(\pi_{ij}) = \log\left(\frac{\pi_{ij}}{1-\pi_{ij}}\right)$
- X_i is the design matrix for fixed effect covariates
- β is the vector containing estimates for fixed effect covariates
- Z_i is the design matrix for random effects, $i=1$ to number of hospitals
- b_i is the vector of random intercepts (hospitals), $i=1$ to number of hospitals

Covariate selection

Differences in patient experiences between groups may reflect differences in experiences of care. However, they may also reflect differences in expectations or the way various groups tend to respond to surveys. To enable fairer comparisons across hospitals, the enhanced reporting method looks at which patient characteristics may be consistently associated with more positive or less positive reported experiences.

Information regarding rurality of patients and socio-economic status (SES) were also considered as they may relate to response tendency. However, BHI chose not to include factors such as rurality or SES as these factors may reflect differences in care. Instead, analyses of results by these patient groups is presented in BHI's interactive data portal, Healthcare Observer, to allow hospitals to see which patient groups reported more or less positive experience of care. A list of all patient characteristics considered

for inclusion in the model proposed for standardised comparisons and how they were sourced are included in Table 5.

Information on patient health status, such as self-reported overall health or mental health status, could also influence both experiences of care and responding tendency, but were not considered for inclusion in the model. Currently BHI is only standardising comparisons for experience of care questions by adjusting patient, not clinical, characteristics.

For age and sex, missing values were filled in using administrative data. Following this, there was no missing data for age and sex. Missing data for other patient characteristics were included in all analyses as an extra category in the model. Missing data in performance-related questions were excluded from all analyses.

Table 5 Patient characteristics considered for adjustment

Variable	Source	Categories
Age	Survey question, or using administrative data if missing	18-34, 35-54, 55-74, 75+
Sex	Survey question, or using administrative data if missing	Male, Female
Education	Survey question	Completed year 12, trade/technical certificate/diploma, university degree, postgraduate degree, missing
Language mainly spoken at home	Survey question	English, language other than English, missing
Stay type	Administrative data	Same-day admission, overnight admission
Spent time in ED on arrival	Survey question	Yes, no, missing
Proxy response	Survey question	The patient, the patient with help, other people on patient's behalf, missing
Modality of survey response	Response data	Paper, online

These patient characteristics were then passed through two selection stages, as follows:

1. Univariate models were fitted for each patient characteristic (covariate) for all performance-related questions in the survey. Covariates with $p < 0.1$ in the univariate models for at least 50% of the questions were considered for inclusion in the multivariate model.
2. Multivariate logistic mixed models were fitted across all performance-related questions in the survey using the covariates selected from stage one, with age and sex included in all models. Forward stepwise modelling was used based on the equation above, including age, sex and all additional covariates added appropriately following a forward stepwise approach. Selected interaction terms were also tested.

Within each outcome (i.e. performance-related survey question) the models were ranked by the Akaike Information Criterion (AIC) – the model with the smallest AIC value was assigned the highest rank of 1. The AIC was recommended as an appropriate method for selecting models where different fixed effects are included as it applies a penalty for the number of covariates in order to protect against model overfitting.¹

The following values were obtained:

- Number of questions for which the model was ranked first
- Mean rank across all questions
- Mean AIC value across all questions.

These values were used to identify the optimal model to create adjusted comparisons for the survey results, with each survey from the NSW Patient Survey Program assessed independently. That is, the optimal model had a high count of 1st ranking, a low mean rank, and a low mean AIC relative to other models, across all performance-related questions in the survey.

Finally, we excluded covariates that marginally improved the model by comparing the models' AIC values, to define a parsimonious number of patient-related covariates to use in standardised comparisons. We also excluded covariates that were not part of patient characteristics (e.g. whether patients were staying overnight or had same-day admission).

This is because standardised comparisons are intended to control for differences only in patient characteristics, and some of these factors were considered to be under the control of hospital management rather than patients.

In all cases, further assessments of the AIC summary values indicated that the smaller model had results very similar to those with the hospital factors included (e.g. stay type, admission type). The remaining covariates were then used in the final model to adjust for each performance-related question to create the standardised comparisons. Table 6 presents a list of covariates that were considered for adjustment by selection stage and survey.

Table 6 Covariates considered for adjustment for comparisons at each selection stage by survey

	Available for adjustment	Passed univariate model selection threshold (stage 1)	Passed multivariate model selection threshold (stage 2)	After consultation with expert panel and confirmed by sensitivity analyses
Age	✓	✓	✓	✓
Sex	✓	✓	✓	✓
Education	✓	✓	✓	✓
Language spoken at home	✓	✓	✓	✓
Stay type	✓	✓	✓	
ED on arrival	✓	✓	✓	
Proxy response	✓	✓	✓	
Mode of response	✓	✓	✓	

Model-based comparisons

The model calculates an estimate for each hospital's random intercept, and produces a p-value to indicate how likely these estimates are different from the average, or NSW value.

The exponential values of the estimated hospital random intercepts, based on the random intercept logistic regression model, can be used to estimate the odds of a positive experience (e.g. 'very good' for overall care question) for the hospital with reference to an 'average' hospital. The p-value for each hospital intercept estimate was used to determine if the hospital was significantly different from NSW, when adjusted for patient characteristics, using the following guidelines:

- If the p-value was less than the significance level (0.01) and the solution for the hospital random intercept was greater than 0, the hospital was flagged as having a more positive result than NSW.

- If the p-value was less than the significance level and the random effect solution was less than 0, the hospital was flagged as having a less positive result than NSW.
- If the p-value was greater than the significance level, the hospital was flagged grey as not significantly different to NSW.
- If a result has been flagged as 'interpret with caution', comparisons are not highlighted due to the lack of precision in the result.

When making multiple comparisons there is an increased likelihood of flagging a difference that is not 'real', but due to chance. To mitigate this issue, a p-value of 0.01 was used to reduce the likelihood of identifying differences due to chance to 1 comparison in 100 (from 1 in 20, with the more commonly used p-value of 0.05). Sampling weights were used in all models to ensure the comparisons were representative of the NSW patient population.

Statistical software

SAS software version 9.4 was used for all statistical analyses (Copyright © 2018 SAS Institute Inc. SAS and all other SAS Institute Inc. product or service names are registered trademarks or trademarks of SAS Institute Inc., Cary, NC, USA. SAS 9.4 (English)). PROC GLIMMIX procedure was used for performing logistic mixed models.

Sensitivity analyses

For AAPS, eight covariates were identified as statistically significant predictors of selecting the “event” for questions in the survey (Table 6, Stage 2). An expert panel convened by BHI assessed the explanatory power of an eight-covariate model to a four-covariate model by eliminating covariates that were more likely to be under the control of the hospital, as presented in Table 7.

To evaluate this recommendation from the expert panel, both the full eight-covariate model and a four-covariate model with age, sex, education and language spoken at home (reduced model) were fit for all performance-related survey questions in the AAPS 2017 data. Comparison of statistical significance of these survey questions for each hospital revealed minimal difference in average AIC between the two models (average AIC=14083 vs. 14331 for full vs. reduced model), and two models resulted in similar outlier status for hospitals. Therefore, the reduced four-covariate model will be adopted and used for standardised comparisons for AAPS.

Specialist hospitals in Adult Admitted Patient Survey

For AAPS, we do not compare A3 hospitals (specialist hospitals) such as Royal Hospital for Women, Calvary Mater Hospital and Sydney Eye Hospital due to their difference in patient mix.

Table 7 Covariates in an eight-covariate model excluded in the four-covariate model

Mode of survey response	these may be more a reflection of age than anything else (e.g. younger people are more likely to complete an online questionnaire and complete it themselves)
Proxy response	
Whether they spent time in the emergency department on arrival (AAPS)	decisions may be based on service characteristics rather than a patient characteristic
Stay type (same-day vs overnight)	decisions may be based on service characteristics rather than a patient characteristic

Appendix 1

Missing and 'Don't know' responses

Table 8 Proportion of missing and/or 'don't know' responses for questions, AAPS 2018

Number	Question	Missing %	Don't know %	Missing + Don't know %*
1	Was your stay in hospital planned in advance or an emergency?	3.4		3.4
2	When you arrived in hospital did you spend time in the emergency department?	3.9	2.1	6.0
3	Were the emergency department staff polite and courteous?	2.4	1.2	3.6
4	Do you think the amount of time you spent in the emergency department was...?	3.5	4.9	8.4
5	Were the staff you met on your arrival to hospital polite and courteous?	1.7		1.7
6	Do you think the time you had to wait from arrival at hospital until you were taken to your room or ward was...?	2.5	3.1	5.6
7	How clean were the wards or rooms you stayed in while in hospital?	3.4		3.4
8	How clean were the toilets and bathrooms that you used while in hospital?	4.2		4.2
9	Did you see nurses wash their hands, or use hand gel to clean their hands, before touching you?	3.3	12.4	15.7
10	Did you see doctors wash their hands, or use hand gel to clean their hands, before touching you?	4.0	17.8	21.8
11	Were you given enough privacy when being examined or treated?	3.2		3.2
12	Were you given enough privacy when discussing your condition or treatment?	3.4		3.4
13	If you needed to talk to a doctor, did you get the opportunity to do so?	4.2		4.2
14	When you had important questions to ask a doctor, did they answer in a way you could understand?	4.4		4.4
15	In your opinion, did the doctors who treated you know enough about your medical history?	5.0		5.0
16	Did you have confidence and trust in the doctors treating you?	4.4		4.4
17	Were the doctors kind and caring towards you?	4.6		4.6
18	Overall, how would you rate the doctors who treated you?	4.2		4.2
19	If you needed to talk to a nurse, did you get the opportunity to do so?	4.3		4.3
20	When you had important questions to ask a nurse, did they answer in a way you could understand?	4.6		4.6
21	In your opinion, did the nurses who treated you know enough about your care and treatment?	4.9		4.9
22	Did nurses ask your name or check your identification band before giving you any medications, treatments or tests?	4.4	3.4	7.8
23	Did you have confidence and trust in the nurses treating you?	4.4		4.4
24	Were the nurses kind and caring towards you?	4.4		4.4
25	Overall, how would you rate the nurses who treated you?	4.4		4.4
26	Did you have any hospital food during this stay?	4.2		4.2
27	How would you rate the hospital food?	1.9		1.9

Number	Question	Missing %	Don't know %	Missing + Don't know %*
28	Did you have any special dietary needs (e.g. vegetarian, diabetic, food allergies, religious, cultural, or related to your treatment)?	2.2		2.2
29	Was the hospital food suitable for your dietary needs?	2.0	1.6	3.6
30	Did the health professionals introduce themselves to you?	4.1		4.1
31	Did the health professionals explain things in a way you could understand?	4.4		4.4
32	During your stay in hospital, how much information about your condition or treatment was given to you?	4.4		4.4
33	Did you have worries or fears about your condition or treatment while in hospital?	4.6		4.6
34	Did a health professional discuss your worries or fears with you?	2.2		2.2
35	Were you involved, as much as you wanted to be, in decisions about your care and treatment?	4.9		4.9
36	How much information about your condition or treatment was given to your family, carer or someone close to you?	4.5	4.4	8.9
37	Did you ever receive contradictory information about your condition or treatment from the health professionals?	5.7		5.7
39	Did you feel you were treated with respect and dignity while you were in the hospital?	3.3		3.3
40	Were your cultural or religious beliefs respected by the hospital staff?	4.6		4.6
41	Were you ever treated unfairly for any of the reasons below?	11.0		11.0
42	How would you rate how well the health professionals worked together?	4.0		4.0
43	Was a call button placed within easy reach?	4.2	4.4	8.6
44	Was your sleep ever disturbed due to noise at night?	10.8		10.8
45	Not including the reason you came to hospital, during your hospital stay, or soon afterwards, did you experience any of the following complications or problems?	8.1		8.1
47	In your opinion, were the health professionals open with you about this complication or problem [that you experienced during or soon after your visit]?	4.3		4.3
48	Were you ever in any pain while in hospital?	4.0		4.0
49	When you had pain, was it usually severe, moderate or mild?	2.6		2.6
50	Do you think the hospital staff did everything they could to help manage your pain?	1.6		1.6
51	During your stay in hospital, did you have any tests, X-rays or scans?	3.9		3.9
52	Did a health professional discuss the purpose of these tests, X-rays or scans with you?	3.3		3.3
53	Did you receive test, X-ray or scan results while you were still in hospital?	3.9		3.9
54	Did a health professional explain the test, X-ray or scan results in a way that you could understand?	2.2		2.2
55	During your stay in hospital, did you have an operation or surgical procedure?	4.0		4.0
56	Was your operation or surgical procedure planned before you came to hospital?	2.5		2.5
57	Thinking back to when you first tried to book an appointment with a specialist, how long did you have to wait to see that specialist?	3.6	11.4	15.0

Number	Question	Missing %	Don't know %	Missing + Don't know %*
58	From the time a specialist said you needed the operation or surgical procedure, how long did you have to wait to be admitted to hospital?	3.2	4.7	7.9
59	Do you think the total time between when you first tried to book an appointment with a specialist and when you were admitted to hospital was...?	3.2	3.7	6.9
60	Before your arrival, how much information about your operation or surgical procedure was given to you by the hospital?	3.4	4.0	7.4
61	Before your operation or surgical procedure began, did a health professional explain what would be done in a way you could understand?	3.3		3.3
62	After the operation or procedure, did a health professional explain how the operation or surgical procedure had gone in a way you could understand?	3.2	2.2	5.4
63	Did you feel involved in decisions about your discharge from hospital?	4.6		4.6
64	At the time you were discharged, did you feel that you were well enough to leave the hospital?	4.4		4.4
65	Thinking about when you left hospital, were you given enough information about how to manage your care at home?	4.3		4.3
66	Did hospital staff take your family and home situation into account when planning your discharge?	4.8	2.8	7.5
67	Thinking about when you left hospital, were adequate arrangements made by the hospital for any services you needed?	4.9		4.9
68	Did hospital staff tell you who to contact if you were worried about your condition or treatment after you left hospital?	4.9	9.3	14.3
69	Were you given or prescribed any new medication to take at home?	4.8		4.8
70	Did a health professional in the hospital explain the purpose of this medication in a way you could understand?	3.4		3.4
71	Did a health professional in the hospital tell you about medication side effects to watch for?	4.2		4.2
72	Did you feel involved in the decision to use this medication in your ongoing treatment?	4.2		4.2
73	Did the hospital provide you with a document summarising the care you received in hospital (e.g. a copy of the letter to your GP or a discharge summary)?	5.4	10.7	16.1
74	On the day you left hospital, was your discharge delayed?	4.7		4.7
75	How long was the delay? [in discharge]	1.9	5.4	7.2
76	Did a member of staff explain the reason for the delay? [in discharge]	2.8		2.8
77	What were the main reasons for the delay? [in discharge]	3.3	6.1	9.4
78	Overall, how would you rate the care you received while in hospital?	1.6		1.6
79	How well organised was the care you received in hospital?	1.7		1.7
80	If asked about your hospital experience by friends and family how would you respond?	1.9		1.9
81	Did you want to make a complaint about something that happened in hospital?	2.9		2.9
82	Did the care and treatment received in hospital help you?	2.6		2.6
83	Is the problem you went to hospital for...?	4.1		4.1

Number	Question	Missing %	Don't know %	Missing + Don't know %*
84	In the week before your hospital stay, how difficult was it for you to carry out your normal daily activities (e.g. physical activity, going to work, caring for children)?	5.0		5.0
85	About one month after your discharge from hospital, how difficult was it for you to carry out your normal daily activities?	4.4		4.4
86	In the month following your discharge, did you go to an emergency department because of complications related to the care you received?	3.9	1.5	5.4
87	In the month following your discharge, were you re-admitted to any hospital because of complications related to the care you received?	3.8	1.2	5.0
88	What year were you born?	2.3		2.3
89	What is your gender?	1.3		1.3
90	Language mainly spoken at home	1.9		1.9
91	Did you need, or would you have liked, to use an interpreter at any stage while you were in hospital?	1.0		1.0
92	Did the hospital provide an interpreter when you needed one?	2.0		2.0
93	Aboriginal and/or Torres Strait Islander origin	3.9		3.9
94	Did you see an Aboriginal Health Worker while you were at the hospital?	3.4	6.3	9.7
95	Highest level of education completed	4.4		4.4
96	In general, how would you rate your health?	2.3		2.3
97	Which, if any, of the following longstanding conditions do you have (including age related conditions)?	5.3		5.3
98	Does this condition(s) cause you difficulties with your day-to-day activities?	3.9		3.9
99	Are you a participant of the National Disability Insurance Scheme (NDIS)?	4.7	8.1	12.8
100	Who completed this survey?	2.4		2.4
101	Do you give permission for the Bureau of Health Information to link your answers from this survey to health records related to you (the patient)?	12.1		12.1

Appendix 2

Derived measures

Definition

Derived measures are those for which results are calculated indirectly from respondents' answers to a survey question. These tend to be from questions that contain a 'not applicable' type response option and are used to gather information about the array of patients' needs.

Derived measures involve the grouping together of more than one response option to a question. The derived measure 'Quintile of Disadvantage' is an exception to this rule (for more information on this, please see the *Data Dictionary: Quintile of disadvantage*).

Statistical methods

Results are expressed as the percentage of respondents who chose a specific response option/s for a question. The reported percentage is calculated as the numerator divided by the denominator (see definitions below).

Results are weighted as described in this report.

Numerator

The number of survey respondents who selected a specific response option/s to a certain question, minus exclusions.

Denominator

The number of survey respondents who selected any of the response options to a certain question, minus exclusions.

Exclusions

For derived measures, the following are usually excluded:

- Response: 'don't know/can't remember' or similar non-committal response
- Response: invalid (i.e. respondent was meant to skip a question but did not)
- Response: missing (with the exception of questions that allow multiple responses or a 'none of these' option, to which the missing responses are combined to create a 'none reported' variable).

Interpretation of indicator

The higher the percentage, the more respondents fall into that response category.

The following questions and responses were used in the construction of the derived measures.

Table 9 Derived measures for the Adult Admitted Patient Survey 2018 questionnaire

Derived measure	Question	Derived measure categories	Response options
Needed to talk to a doctor	Q13. If you needed to talk to a doctor, did you get the opportunity to do so?	Needed to talk to doctor	Yes, always Yes, sometimes No, I did not get the opportunity
		No need to talk to doctor	I had no need to talk to a doctor
Had important questions to ask a doctor	Q14. When you had important questions to ask a doctor, did they answer in a way you could understand?	Asked doctor questions	Yes, always Yes, sometimes No, I did not get answers I could understand
		Didn't ask any questions	I did not ask any questions
Needed to talk to a nurse	Q19. If you needed to talk to a nurse, did you get the opportunity to do so?	Needed to talk to nurse	Yes, always Yes, sometimes No, I did not get the opportunity
		No need to talk to nurse	I had no need to talk to a nurse
Had important questions to ask a nurse	Q20. When you had important questions to ask a nurse, did they answer in a way you could understand?	Asked nurse questions	Yes, always Yes, sometimes No, I did not get answers I could understand
		Didn't ask any questions	I did not ask any questions
Wanted information about condition or treatment during stay	Q32. During your stay in hospital, how much information about your condition or treatment was given to you?	Wanted information	Not enough The right amount Too much
		Not applicable	Not applicable to my situation
Wanted to be involved in decisions about care and treatment	Q35. Were you involved, as much as you wanted to be, in decisions about your care and treatment?	Wanted involvement	Yes, definitely Yes, to some extent No
		Didn't want or too unwell for involvement	I was not well enough I did not want or need to be involved
Had family/someone close who wanted information about condition or treatment	Q36. How much information about your condition or treatment was given to your family, carer or someone close to you?	Wanted information	Not enough Right amount Too much
		Not applicable	It was not necessary to provide information to any family or friends

Derived measure	Question	Derived measure categories	Response options
Had religious or cultural beliefs to consider	Q40. Were your cultural or religious beliefs respected by the hospital staff?	Had beliefs to consider	Yes, always Yes, sometimes No, my beliefs were not respected
		Beliefs not an issue	My beliefs were not an issue
Were you ever treated unfairly for any of the reasons below?	Q41. Were you ever treated unfairly for any of the reasons below?	Treated unfairly	Age Sex Aboriginal background Ethnic background Religion Sexual orientation A disability that you have Marital status Something else
		Not treated unfairly	I was not treated unfairly
Experienced complication or problem during or shortly after hospital stay	Q45. Experienced complication or problem during or shortly after hospital stay (derived measure)	Experienced complication	An infection Uncontrolled bleeding A negative reaction to medication Complication from surgery Complication from tests/procedures A blood clot A pressure wound A fall Any other complication or problem
		None reported	None of these Missing
In your opinion, were the health professionals open with you about this complication or problem?	Q47. In your opinion, were the health professionals open with you about this complication or problem [that you experienced during or soon after your visit]?	Occurred in clinic	Yes, completely Yes, to some extent No
		Occurred after left	Not applicable, as it happened after I left
Wanted explanation of what would be done in operation or surgical procedure	Q61. Before your operation or surgical procedure began, did a health professional explain what would be done in a way you could understand?	Wanted explanation	Yes, completely Yes, to some extent No
		Didn't want explanation	I did not want or need an explanation

Derived measure	Question	Derived measure categories	Response options
Wanted to be involved in decisions about their discharge	Q63. Did you feel involved in decisions about your discharge from hospital?	Wanted involvement	Yes, definitely Yes, to some extent No, I did not feel involved
		Didn't want involvement	I did not want or need to be involved
Needed information on how to manage care at home	Q65. Thinking about when you left hospital, were you given enough information about how to manage your care at home?	Needed information	Yes, completely Yes, to some extent No, I was not given enough
		Didn't need information	I did not need this type of information
Needed family and home situation taken into account when planning discharge	Q66. Did hospital staff take your family and home situation into account when planning your discharge?	Had situation to consider	Yes, completely Yes, to some extent No, staff did not take my situation into account
		Not necessary	It was not necessary
Needed services after discharge	Q67. Thinking about when you left hospital, were adequate arrangements made by the hospital for any services you needed?	Needed services	Yes, completely Yes, to some extent No, arrangements were not adequate
		Didn't need services	It was not necessary
Wanted to be involved in decision to use medication in ongoing treatment	Q72. Did you feel involved in the decision to use this medication in your ongoing treatment?	Wanted involvement	Yes, completely Yes, to some extent No, I did not feel involved
		Didn't want involvement	I did not want or need to be involved

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About the Bureau of Health Information

The Bureau of Health Information (BHI) is a board-governed organisation that provides independent information about the performance of the NSW healthcare system.

BHI was established in 2009 and supports the accountability of the healthcare system by providing regular and detailed information to the community, government and healthcare professionals. This in turn supports quality improvement by highlighting how well the healthcare system is functioning and where there are opportunities to improve.

BHI manages the NSW Patient Survey Program, gathering information from patients about their experiences and outcomes of care in public hospitals and other healthcare facilities.

BHI publishes a range of reports and information products, including interactive tools, that provide objective, accurate and meaningful information about how the health system is performing.

BHI's work relies on the efforts of a wide range of healthcare, data and policy experts. All of our assessment efforts leverage the work of hospital coders, analysts, technicians and healthcare providers who gather, codify and supply data. Our public reporting of performance information is enabled and enhanced by the infrastructure, expertise and stewardship provided by colleagues from NSW Health and its pillar organisations.

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