CASE STUDY

Estimating staffing requirements using workload indicators of staffing need at Braun District Hospital in Morobe Province, Papua New Guinea

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Abstract

Background: Papua New Guinea has seen some improvements in health indicators over the past years, but the pace of improvements is not as robust as expected. The Health Services Plan for Braun District Hospital redevelopment identified the importance of reflecting the hospital’s role in the broader health system, particularly in upgrading the services to service a bigger population. In August 2020, the hospital was upgraded from a health centre—level 3 to a district hospital level 4. The need for assessing human resources for health requirements for this level of care was thus necessary.

Methods: The National Department of Health approved the use of the workload indicators of staffing need as the best tool to support in estimating staff requirements for the newly upgraded hospital. The focus was on clinical and non-clinical staff. Using already developed workload components and activity standards by the expert working groups for level 4 facilities, we visited the facility and collected data through interviews with the Lutheran Health Services representative, hospital management and staff. The technical task force reviewed daily registers, monthly reports and the data in the electronic national health information systems. The information collected was analysed using the workload indicators of staffing need software and interpreted.

Results: There were staffing shortages among the clinical staff like the medical officers, nursing officers, health extension officers, pharmacists, radiology staff unit and in the laboratory staff. Shortages among the non-clinical staff were recorded by the cashiers, security officers, drivers and boat skippers. The results showed that the facility lacks a medical laboratory technologist, pharmacists and a medical imaging technologist. The community health workers in this facility are utilized in all the areas where shortages are registered to multitask.

Conclusion: The results from this WISN study provide evidence for basing staffing decisions on. The WISN results from Braun District Hospital show that the facility requires a total of 33 inpatient nurses against the existing 21 inpatient nurses thus giving a staff gap of −12 and a WISN ratio of 0.67. It is thus recommended that the hospital management prioritizes recruitment of nurses or if no resources, reassign one of the outpatient nurses to alleviate the...
Background
Papua New Guinea (PNG) has a government-funded health system throughout the country. It is supplemented by government-subsidized health services provided by various Christian missions such as the Lutheran Health services. The churches are a major partner providing 50% of the health care services mostly in the rural areas [1]. The 2007 Provincial Health Authority Act [2, 3] enabled the provincial government to establish Provincial Health Authorities (PHAs) responsible for both primary and secondary health care in the provinces. This legislation streamlines the provision of health services at the provincial level and brings together the provincial health departments, hospitals, and district health services under one management board.

The Health Plan [4] was developed to strengthen primary health care (for all) and improve service delivery to the rural majority and the urban disadvantaged and ensure quality health care services are readily accessible and affordable for all. The health services are organized into six levels of care namely the village health posts, community health posts, health centres, district hospitals, provincial hospitals and finally the national referral hospital [5–7].

The NDoH, Medical Standards Division, Workforce Standards and Accreditation Branch (WSA) have the mandate of streamlining workforce standards for the country to enable achievement of the Universal Health Coverage (UHC) and improve health outcomes in the country towards achievement of national and global health commitments [8]. Despite achieving considerable success through the multi-sectoral approach in strengthening the human resources for health capacities, there still exist some gaps such as imbalances in the development and distribution of health workers. In addition to shortages of qualified health professionals in underserved areas, there are significant variations in health services and their quality which causes inequities in health outcomes [9].

With the support of WHO, the WSA branch is working closely with PHAs and health facilities at various levels to advance long term solutions to improve health workers numbers distribution and utilization to ensure quality care for all. The country has integrated the use of workload indicators of staffing need as the evidence-based method for adoption for health worker planning [10].

From the early 1960s, Braun was a health centre serving a small island community which has since grown and services have equally expanded. It is run by Lutheran Health Services (LHS) and located in Finschafen District, Morobe Province in Momase Region of PNG. The hospital status was upgraded from Level 3 to Level 4 in August 2020. The facility has a bed capacity of 120 beds and serves a greater population with a staff capacity of 56 both clinical and non-clinical staff. The upgrading of Braun District Hospital was deemed necessary to ease referral for the primary care facilities in Morobe Province and decongest the provincial and regional facilities.

The overall goal of this study was to determine staffing requirements based on workloads for improved health services in the new upgraded hospital. The results would guide the hospital management board and sponsors on optimum numbers of health workers required per cadre for improved quality health services using WISN.

Methods
The WHO WISN methodology was introduced and approved for use in the country in 2017. The WSA team was trained as the Technical Task Force (TTF) to lead the process of WISN in the country. Expert working groups (EWGs) for all the cadres were trained and later develop the workload components for all the cadres and the corresponding activity standards for adoption in the country. The workload components were validated, approved and printed for use in the country. Available working time (AWT) for the facility for each of the cadres was established. Using cadre-specific workload components, the TTF visited Braun District Hospital to gather health service statistics for 2019 for use in the WISN software. The results generated from the software were analysed and interpreted. Staff interviews, management and LHS administration were also conducted to enable further understanding. Other sources of health service statistics were the daily registers and the partial health information systems.

Setting of the study
The study was set in Braun District hospital in Finschafen District, Morobe Province in the wider region of Momase in Papua New Guinea (PNG). The study focused on all the staff of Braun District Hospital. It included both the

Keywords: Clinical staff, Non-clinical staff, Workload indicators of staffing need
Table 1: Available working time for all the staff at Braun District Hospital

| Cadre                  | Working days per week | Working hours per day | Annual leave | Public holidays | Sick leave | Training days | Non-working days | Non-working weeks | Working weeks | Working days | No. of hours per year |
|------------------------|-----------------------|-----------------------|--------------|-----------------|------------|---------------|------------------|-------------------|---------------|-------------|-----------------------|
| Dental therapist       | 5                     | 8                     | 10           |                  |            | 10            | 2                | 50               | 250           | 2000        |
| Laboratory assistant   | 5                     | 8                     | 10           |                  |            | 10            | 2                | 50               | 250           | 2000        |
| Health extension officer | 5                  | 8                     | 15           | 10              | 5          | 30            | 6                | 46               | 230           | 1840        |
| Medical officer        | 5                     | 8                     | 10           |                  | 5          | 15            | 3                | 49               | 245           | 1960        |
| Midwives               | 5                     | 8                     | 14           | 10              |            | 24            | 4.8              | 47.2             | 236           | 1888        |
| Outpatient nurses      | 5                     | 8                     | 15           | 10              |            | 25            | 5                | 47               | 235           | 1880        |
| Ophthalmic assistants  | 5                     | 8                     | 23           | 10              |            | 33            | 6.6              | 45.4             | 227           | 1816        |
| In patient nurses      | 5                     | 8                     | 15           | 10              |            | 25            | 5                | 47               | 235           | 1880        |
| Theatre nurses         | 5                     | 8                     | 15           | 10              |            | 25            | 5                | 47               | 235           | 1880        |
| Anaesthetic technical officer | 5             | 8                     | 30           | 10              |            | 10            | 2                | 50               | 250           | 2000        |
| Physiotherapist        | 5                     | 8                     | 30           | 10              |            | 40            | 8                | 44               | 220           | 1760        |
| Pharmacy assistant     | 5                     | 8                     | 5            | 10              |            | 15            | 3                | 49               | 245           | 1960        |
| X-ray assistant        | 5                     | 8                     | 10           |                  |            | 10            | 2                | 50               | 250           | 2000        |

The study also involved non-clinical health workers who work for 8 h for 5 days per week and rest on public holidays at 2080 h per year.

Another set were non-clinical staff whose positions are filled throughout the year at 8736 h per year in shifts.
clinical and non-clinical staff in all the service areas of the hospital.

**Sampling design, size and procedure**

This was a case-specific analysis for Braun District Hospital. Both clinical and non-clinical staff were included in the study. The clinical staff included: medical officers, nursing officers, midwives, health extension officers, community health workers, ophthalmic assistant, dental therapist, medical laboratory assistants, X-ray assistant, physiotherapist and pharmacy assistants. The non-clinical staff included: the hospitals’ health administrator, statistician, accountant, accounts clerk, cashier, key board operator, electrician, plumber, drivers, boat skippers, security officers and the morgue attendant.

The TTF held an initial meeting with all the service areas managers in the hospital to orient them on the agenda of the week to avoid disruption of the hospital services. The daily registers submitted provided the activities conducted and the records of each of the services. The human resource manager from LHS provided all the administrative records that supported the WISN study such as staff numbers, information on staff absences mainly the annual, training and sick leaves. An overview of the HRH management practices implemented by the hospitals under LHS was highlighted. This information was critical in the establishment of AWT for each of the cadres and shift programmes in the facility. Further, information about the services offered in the facility, service areas and current staffing based on the workload components developed for each cadre was collected. The hospital statistician shared the monthly and annual statistics from the electronic National Health Information System (eNHIS) which had data for some key indicators and not all services as listed in the data collection sheet. Data verification and validation were conducted before being uploaded into the WISN software.

**Results**

For each of the cadres, AWT was established as shown in Table 1. The AWT ranged from 1760 to 2000 h for year of study. Both the inpatient and outpatient nurses registered an AWT of 1880 h each while the medical officer had a total of 1960 h. The health extension officer registered a total of 1840 h as AWT. While the dental therapist, medical laboratory assistants and the X-ray assistants all recorded 2000 h as AWT. The physiotherapist had an AWT of 1760 h for the year and the midwives had an AWT of 1888 h for the year 2019. The non-clinical staff worked under 2 types of shifts arrangements. There were those who worked for 8 h per day for 5 days in a week and rested on all the public holidays like the accountant, health administrator, statistician, accounts clerk, cashier and the key board operator. Drivers, boat skippers, security officers worked for 24 h per day, 7 days a week throughout the year. Their posts had to be filled throughout.

Still on Table 1, the results show that the facility had no records on the sick leaves from all the cadres. On training, only the medical officer and the health extension officer had at least 5 days each for training while other cadres had no training throughout the year. As for the annual leave which is a statutory requirement for all the cadres, not all were able to take the annual leaves. They included the dental therapist, laboratory assistant, medical officer, anaesthetic technical officer and the X-ray assistant.

The workload components for each of the cadres and their corresponding activity/service standards for the three workload groups namely: health, support and additional activities were provided for each of the cadres. Table 2 provides the three workload groups, service standards and annual statistics collected in the facility for the 13 clinical cadres under study.

The workload components, activity standards and the annual statistics were first uploaded in the WISN software to provide staffing requirements for health services also known as workload group 1. This was followed by uploading the support activities or workload group 2 activities and the category allowances to get the category allowance factor in percentage and a staff requirement for the support activities. Finally, additional activities or workload group 3 activities were uploaded into the software with the relevant additional allowances to provide the individual allowance standards in hours per year and the individual allowance factor which is the staff required undertaking additional activities. Using the WISN formula for calculating staff requirements of 1 × 2 + 3 = staff requirements, the staffing requirement per cadre were calculated as summarized in Table 3.

Table 3 shows mixed results of balances, shortages and cases of staff surpluses. Balances are recorded among the midwives, physiotherapist and the dental therapist. The existing staff equal the WISN-calculated staffing requirements hence recording a difference of 0 and a WISN ratio of 1.00.

Staffing shortages were recorded across 6 cadres. The staff differences with a negative sign mean a gap or a shortage. The medical laboratory assistants have 2 existing staff and the staffing requirement calculated by WISN is 3 giving a difference of -1 and WISN ratio of 0.67. The medical officers have an existing staff of 1 and the calculated requirement based on workloads is 4 thus a difference of at -3 and WISN ratio of 0.25. The ophthalmic assistants have an existing staff of 1 and the WISN requirement estimates a total of 3 staff thus a gap
Table 2 Workload components and activity standards and annual statistics collected

### Medical officers

| Workload components                        | Service standards | Annual-2019 |
|-------------------------------------------|-------------------|-------------|
| Health service activities (Group 1 activities) |                   |             |
| Consultations                             | 20 min per patient| 5880        |
| Admissions                                | 30 min per patient| 3920        |
| Ward rounds                               | 20 min per patient| 3920        |
| Minor surgeries                           | 17 min per patient| 6918        |
| Intermediate surgeries                    | 45 min per patient| 2613        |
| Major surgeries                           | 259 min per patient| 454         |
| Medical procedures                        | 30 min per patient| 3920        |
| Complex deliveries                        | 60 min per patient| 520         |
| Referrals                                  | 15 min per patient| 321         |
| Assault and injuries                       | 30 min per patient| 1840        |
| Death declaration                          | 10 min per patient| 35          |
| Discharge                                  | 10 min per patient| 5524        |
| Re-attendances                             | 15 min per patient| 11,760      |
| Support activities (Group 2 activities)    |                   |             |
| Morning devotion                           | 45 min per day    |             |
| Daily debriefs                             | 20 min per day    |             |
| Clinical case presentations                | 1 h per week      |             |
| Meeting of paramedics                      | 1 h per month     |             |
| Staff meetings                             | 12 h per year     |             |
| Continuous medical education               | 24 h per year     |             |
| Outreaches                                 | 20 days/year      |             |
| Additional activities (Group 3 activities)  |                   |             |
| Staff supervision                          | 12 h per year     |             |
| Supervision of students                    | 16 h per year     |             |
| General administration                     | 30 min per day    |             |
| Surveillance reporting                     | 32 h per year     |             |
| Monthly reports                            | 12 h per year     |             |
| Medical legal duties                       | 8 h/year          |             |

### Dental therapists

| Health service/group 1                  | No. per year | Service standard/unit | Standard workload |
|-----------------------------------------|--------------|------------------------|-------------------|
| Dental examinations                     | 340          | 15 min/patient         | 8000              |
| Referrals                               | 20           | 10 min/patient         | 12,000            |
| Tooth extractions                       | 340          | 45 min/patient         | 2667              |
| Temporary dressings                     | 18           | 30 min/patient         | 4000              |
| Patient management                      | 340          | 45 min/patient         | 2667              |
| Malaria smear                           | 3261         | 25 min/sample          | 4800              |
| Malaria RDT                             | 515          | 10 min/sample          | 12,000            |
| White cell count                        | 3154         | 12 min/sample          | 10,000            |
| WBC differential                        | 194          | 28 min/sample          | 4286              |
| ESR                                     | 146          | 15 min/sample          | 8000              |
| Platelet count                          | 17           | 12 min/sample          | 10,000            |
| Total lymphocyte count                  | 19           | 12 min/sample          | 10,000            |
| VDRL                                    | 353          | 10 min/sample          | 12,000            |
| TPHA                                    | 438          | 10 min/sample          | 12,000            |
| Health service/group 1                     | No. per year | Service standard/unit | Standard workload |
|-------------------------------------------|--------------|------------------------|-------------------|
| HIV testing                               | 182          | 20 min/sample          | 6000              |
| Hepatitis B                               | 242          | 20 min/sample          | 6000              |
| Widal test                                | 46           | 20 min/sample          | 6000              |
| Pregnancy test                            | 69           | 5 min/sample           | 24,000            |
| Urinalysis strip                          | 396          | 5 min/sample           | 24,000            |
| Urinalysis microscopy                     | 136          | 10 min/sample          | 12,000            |
| Blood fluid split                         | 17           | 5 min/sample           | 24,000            |
| Blood fluid microscopy                    | 13           | 10 min/sample          | 12,000            |
| AFB                                       | 854          | 35 min/sample          | 3429              |
| Other body fluids                         | 36           | 10 min/sample          | 12,000            |
| Gram stain                                | 32           | 10 min/sample          | 12,000            |
| Blood grouping                            | 719          | 10 min/sample          | 12,000            |
| Cross match                               | 250          | 15 min/sample          | 8000              |
| Blood collection                          | 173          | 20 min/sample          | 6000              |
| BSL                                       | 79           | 7 min/sample           | 17,143            |
| Stool for OCP                             | 10           | 8 min/sample           | 15,000            |
| CSF exam                                  | 1            | 9 min/sample           | 13,333            |
| Alkaline phosphate                        | 57           | 6 min/sample           | 20,000            |
| Amylase                                   | 14           | 6 min/sample           | 20,000            |
| Cholinesterase                            | 6            | 6 min/sample           | 20,000            |
| Gamma glutamyl                            | 58           | 6 min/sample           | 20,000            |
| Aspartate A                               | 75           | 6 min/sample           | 20,000            |
| Alanine Amino                              | 63           | 6 min/sample           | 20,000            |
| Leucine Amino                             | 5            | 6 min/sample           | 20,000            |
| Albumin                                   | 61           | 6 min/sample           | 20,000            |
| Blood urea nitrogen                       | 81           | 6 min/sample           | 20,000            |
| Calcium                                   | 7            | 6 min/sample           | 20,000            |
| Creatine                                  | 116          | 6 min/sample           | 20,000            |
| Direct bilirubin                          | 10           | 6 min/sample           | 20,000            |
| Total bilirubin                           | 49           | 6 min/sample           | 20,000            |
| Total cholesterol                         | 1            | 6 min/sample           | 20,000            |
| Triglyceride                              | 9            | 6 min/sample           | 20,000            |
| Total protein                             | 37           | 6 min/sample           | 20,000            |
| Uric acid                                 | 81           | 6 min/sample           | 20,000            |
| Sodium                                    | 99           | 6 min/sample           | 20,000            |
| Potassium                                 | 159          | 6 min/sample           | 20,000            |
| Chloride                                  | 74           | 6 min/sample           | 20,000            |
| C-reactive protein                        | 4            | 6 min/sample           | 20,000            |
| Hepatitis c                               | 25           | 20 min/sample          | 6000              |
| 3. Health Extension Officer               |              |                       |                   |
| TB consultations                          | 160          | 30 min/patient         | 3680              |
| Deaths                                    | 2            | 10 min/patient         | 11,040            |
| Patient reviews                           | 160          | 120 min/patient        | 920               |
| Admission                                 | 160          | 20 min/patient         | 5520              |
| In patient care for TB                    | 160          | 20 min/patient         | 5520              |
| Ward rounds                               | 1443         | 20 min/patient         | 5520              |
| Dispensing of TB drugs                    | 160          | 7 min/patient          | 15,771            |
### Table 2 (continued)

#### Dental therapists

| Health service/group 1         | No. per year | Service standard/unit | Standard workload |
|-------------------------------|--------------|-----------------------|-------------------|
| Referrals                     | 2            | 10 min/patient        | 11,040            |
| Discharges                    | 156          | 20 min/patient        | 5520              |
| Assist in minor surgeries     | 401          | 17 min/patient        | 6494              |

4. Medical Officer

| Consultations                 | 1,784        | 20 min/patient        | 5880              |
| Admissions                    | 1143         | 30 min/patient        | 3920              |
| Ward rounds                   | 1143         | 20 min/patient        | 5880              |
| Minor surgical procedures     | 401          | 17 min/patient        | 6918              |
| Intermediate surgeries        | 319          | 45 min/patient        | 2613              |
| Major surgeries               | 70           | 259 min/patient       | 454               |
| Medical procedures            | 82           | 30 min/patient        | 3920              |
| Complex deliveries            | 31           | 60 min/patient        | 1960              |
| Referrals                     | 251          | 15 min/patient        | 7840              |
| Assault and injuries          | 136          | 30 min/patient        | 3920              |
| Death declaration             | 38           | 10 min/patient        | 11,760            |
| Discharge                     | 1401         | 10 min/patient        | 11,760            |
| Re-attendances                | 7853         | 15 min/patient        | 7840              |

5. Midwives

| Admissions                    | 335          | 20 min/patient        | 5664              |
| Nursing care                  | 335          | 600 min/patient       | 189               |
| Labour management             | 335          | 240 min/patient       | 472               |
| Ward rounds                   | 335          | 20 min/patient        | 5664              |
| Normal deliveries             | 335          | 45 min/patient        | 2517              |
| Immediate Newborn care        | 362          | 35 min/patient        | 3237              |
| Newborn care                  | 364          | 15 min/patient        | 7552              |
| Post-natal care               | 362          | 20 min/patient        | 5664              |
| Discharges                    | 364          | 10 min/patient        | 11,328            |
| Care of the dead              | 2            | 30 min/patient        | 3776              |

6. Nurses—outpatient

| Antenatal clinic              | 352          | 40 min/patient        | 2820              |
| Subsequent visit              | 420          | 25 min/patient        | 4512              |
| Immunization injections       | 6176         | 25 min/patient        | 4512              |
| Immunization oral             | 2348         | 15 min/patient        | 7520              |
| Family planning—condoms      | 8            | 10 min/patient        | 11,280            |
| Family planning—injection     | 309          | 20 min/patient        | 5640              |
| Family planning—insertible    | 156          | 30 min/patient        | 3760              |
| Family planning—natural       | 15           | 25 min/patient        | 4512              |
| Family planning—oral          | 21           | 10 min/patient        | 11,280            |
| Removal of implants           | 2108         | 25 min/patient        | 4512              |
| Malnutrition management       | 240          | 25 min/patient        | 4512              |
| Well baby clinic              | 240          | 25 min/patient        | 4512              |

7. Ophthalmic assistant

| OPD consultations             | 5284         | 20 min/patient        | 5448              |
| Review of patients            | 796          | 10 min/patient        | 10,896            |
| Assessment of refractions     | 579          | 25 min/patient        | 4358              |
| Glass prescriptions           | 579          | 5 min/patient         | 21,792            |
| Assistant in cataract surgery | 182          | 20 min/patient        | 5448              |
### Table 2 (continued)

#### Dental therapists

| Health service/group 1          | No. per year | Service standard/unit | Standard workload |
|--------------------------------|--------------|------------------------|-------------------|
| Assessment of cataracts        | 182          | 35 min/patient         | 3113              |
| Referrals                      | 104          | 15 min/patient         | 7264              |
| Removal of foreign objects     | 16           | 10 min/patient         | 10,896            |
| Fundoscopy                     | 16           | 15 min/patient         | 7264              |
| Eye irrigation                 | 16           | 20 min/patient         | 5448              |
| Application of ointment        | 5284         | 10 min/patient         | 10,896            |
| Post-cataract counselling      | 220          | 25 min/patient         | 4358              |

8. Nurse inpatient

| Activity                        | No. per year | Service standard/unit | Standard workload |
|--------------------------------|--------------|------------------------|-------------------|
| Management of TB                | 160          | 25 min/patient         | 4685              |
| Care of the dead                | 39           | 35 min/patient         | 3346              |
| Medical procedures              | 2866         | 45 min/patient         | 2603              |
| Discharges                      | 2866         | 20 min/patient         | 6856              |
| Formula preparation             | 120          | 50 min/patient         | 2342              |
| Burns                           | 5            | 75 min/patient         | 1562              |
| Post-operative care             | 763          | 35 min/patient         | 3346              |
| Referrals                       | 141          | 30 min/patient         | 3904              |
| Wound dressing                  | 20           | 74 min/patient         | 1583              |
| Blood transfusion               | 35           | 30 min/patient         | 3004              |
| Pre-operative care              | 763          | 45 min/patient         | 2603              |
| Ward rounds                     | 2866         | 75 min/patient         | 1562              |
| OFD assessment                  | 5928         | 20 min/patient         | 5856              |
| Admissions                      | 2866         | 20 min/patient         | 5856              |
| Administration of medications   | 5928         | 25 min/patient         | 4685              |
| Review of patients              | 4650         | 20 min/patient         | 5856              |
| Sample collection               | 1076         | 20 min/patient         | 5856              |
| Nursing care                    | 2866         | 600 min/inpatient day  | 195               |

9. Theatre nurse

| Activity                        | No. per year | Service standard/unit | Standard workload |
|--------------------------------|--------------|------------------------|-------------------|
| Minor surgical procedures       | 384          | 17 min/patient         | 6635              |
| Intermediate surgeries          | 309          | 45 min/patient         | 2507              |
| Major surgeries                 | 70           | 259 min/patient        | 436               |

10. Anaesthetic Technical Officer

| Activity                        | No. per year | Service standard/unit | Standard workload |
|--------------------------------|--------------|------------------------|-------------------|
| Minor surgical procedures       | 384          | 17 min/patient         | 7059              |
| Intermediate surgeries          | 309          | 45 min/patient         | 2667              |
| Major surgeries                 | 70           | 259 min/patient        | 463               |

11. Physiotherapist

| Activity                        | No. per year | Service standard/unit | Standard workload |
|--------------------------------|--------------|------------------------|-------------------|
| Assessment of patients          | 123          | 60 min/patient         | 1760              |
| Review of patients—wards        | 232          | 45 min/patient         | 2347              |
| Ward rounds                     | 232          | 10 min/patient         | 10,560            |
| Management of adults            | 208          | 50 min/patient         | 2112              |
| Management of minors            | 27           | 35 min/patient         | 3017              |
| Manual interventions            | 345          | 74 min/patient         | 1427              |
| Mobility training               | 180          | 60 min/patient         | 1760              |
| Deep breathing exercises        | 24           | 45 min/patient         | 2347              |

12. Pharmacy assistant

| Activity                        | No. per year | Service standard/unit | Standard workload |
|--------------------------------|--------------|------------------------|-------------------|
| Dispensing of dangerous drugs   | 471          | 30 min/patient         | 3920              |
| Medicines dispensing            | 7313         | 25 min/patient         | 4704              |
| Pre-packaging services          | 7784         | 17 min/patient         | 6918              |
of − 2 and WISN ratio of 0.64. Braun Hospital currently has 2 pharmacy staff in the facility but based on the workload, the WISN estimates a requirement of 4 giving a difference of − 2 and a corresponding WISN ratio of 0.50. Finally, only 1 X-ray assistant exists in the facility and the WISN requirements estimates a total of 2 staff thus a difference of − 1 with a WISN ratio of 0.50.

There were circumstances where calculated WISN staff requirements were less than existing staff. Such were recorded by the health extension officers, theatre nurses and anaesthetic technical staff (ATO). The existing health extension officers in the facility at the time of study were 3. The WISN-calculated requirements were estimated at 1 with a WISN ratio of 3.00 hence an extra staff of + 2. On the other hand, the theatre nurse in Braun hospital were 4 and the calculated WISN requirement was estimated as 1 based on the workloads with a WISN ratio of 4.00 meaning a cadre surplus of + 3 while the ATO existing staff were 2 and the calculated requirement was 1 showing a surplus of + 1 with a WISN ratio of 2.00.

There were other results also gathered that are beneficial to the upgraded hospital from the WISN study. During the field visit to the facility, it was observed that the unit had no physiotherapy equipment, the laboratory and the pharmacy would run out of stock of needed reagents, commodities and medication required in the facility. All these have an impact on the specific cadre workload. It was also noted that most of the staff assistants like the medical laboratory assistants, ophthalmic assistant, X-ray assistant and pharmacy assistants were all community health workers (CHWs). This is an indication of staff sharing and shifting tasks where the CHW undertakes roles that are not their traditional roles.

Non-clinical staffing requirements were also estimated based on the shifting programmes. The facility had a category of non-clinical staff working for 5 days, 8 h per day with non-working days during public holidays. Such positions have 2080 h per year. The calculated staffing requirements for such posts estimated a requirement of 0.96 staff rounded up to 1. On the other hand, there were positions that require staff throughout the year for 24 h daily, 7 days a week and 365 days. They operated in 2 shifts with a total of 8736 h. Such positions require a total

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### Table 2 (continued)

| Health service/group 1 | No. per year | Service standard/unit | Standard workload |
|------------------------|--------------|-----------------------|------------------|
| Compounding            | 363          | 40 min/patient         | 2940             |
| 13. X-ray assistant    |              |                       |                  |
| Plain radiographs      | 3105         | 30 min/patient         | 4000             |
| ECG                    | 62           | 45 min/patient         | 2667             |

### Table 3 WISN-calculated staffing requirements clinical staff at Braun District Hospital

| Type of staff             | Existing staff | Calculated requirement | Difference | WISN ratio |
|---------------------------|----------------|------------------------|------------|------------|
| Dental therapists         | 1              | 1                      | 0          | 1.00       |
| Medical laboratory assistants | 2          | 3                      | − 1        | 0.67       |
| Health extension officers | 3              | 1                      | 2          | 3.00       |
| Medical officers          | 1              | 4                      | − 3        | 0.25       |
| Midwives                  | 6              | 6                      | 0          | 1.00       |
| Outpatient nurses         | 5              | 4                      | 1          | 1.25       |
| Ophthalmic assistants     | 1              | 3                      | − 2        | 0.33       |
| In patient nurses         | 21             | 33                     | − 12       | 0.64       |
| Theatre nurses            | 4              | 1                      | 3          | 4.00       |
| Anaesthetic technical staff | 2          | 1                      | 1          | 2.00       |
| Physiotherapists          | 1              | 1                      | 0          | 1.00       |
| Pharmacy assistants       | 2              | 4                      | − 2        | 0.50       |
| X-ray assistants          | 1              | 2                      | − 1        | 0.50       |
of 4.2 staff (8736/2080) for shifting. In other words, 4 full-time staff working in shifts is recommended for such positions like of the security officers and the drivers. This covers the continuous shift work all through the year. It was noted some non-clinical health workers engaged in more than one role. For example, the statistician functions as the electrician and a driver at the same time.

Discussion

Upgrading a health facility requires evidence to provide the health managers with the right information to make decisions on staffing requirements and even necessary equipment to respond to the new status of the facility. Thus, the WISN results provide the staffing requirements for each of the cadres in the health facility. Some indicated shortages, other balances while others an indication of more staff than required. These results provide further insights to the health workforce decisions.

For those cadres that reported a difference of 0 and WISN ratio of 1, the results were interpreted as having a staff balance meaning that the existing staff were just sufficient to offer the services of that facility within the professional standards of the country. Thus, no action was required but sustenance of the services. However, if the new status of the facility anticipates increased workloads, the results can still be used to estimate future staffing based on expected increase of services as reported by other studies [11, 12].

For those cadres that had results showing negative differences, it was interpreted as staff shortages that require prioritization or reassignment of available cadres in cases of scarce resources like it is the situation in PNG. If the facility has funds, staff hiring can be prioritized too. For example, in the case of inpatient nurses that registered a gap of −12, the immediate decision administrative decision before staff hiring could be to reassign one of the surplus outpatient nurses to join the inpatient nurses and reduce the workload pressure of the inpatient nurses. Alternatively, assign some of the theatre nurses to support the inpatient nurses during low seasons or when no surgical procedure cases are booked. For the medical officer, a shortage of -3 staff was registered. The immediate action could be to assign the +2 surplus health extension officers to support in consulting at the outpatient department and only to allow the only medical officer to attend to more critical cases that require his expertise and reduce the high workload pressure.

The higher the shortages, the higher the workload pressures and shown by the ratios that are less than 1. It further means that the cadres could be working under pressure, thus services have possibilities of being compromised. On the contrary, the staff cadres whose WISN ratios were more than 1 and positive differences, it meant that the cadres in existence were more than what the facility required. There were also cases of surplus staff meaning the calculated estimated requirement was less than the existing staff. Positive differences indicate that the number of staff for specific cadre in the facility is more than the staff required to cope with the existing workload. It also means that the WISN ratios are more than 1, an indication of low workload pressures. The higher the surpluses in the differences, the higher the WISN ratio registered. Ultimately, the lower the workload pressure on the particular staff cadre. It could also imply that the quality of the services in that facility should be better than those with negative differences due to the existence of more staff. The existing staff should therefore offer the best services as they have no work pressure at all.

The results provide information that resonates with the National Health Services Standards that require health facilities to have the right staff, right equipment and technology. Level 4 health facilities or district hospitals are required to deliver medical, child health/paediatric, maternal and minor surgical services (including public health activities). They also provide clinical support services in pharmacy, pathology, anaesthetics and radiology [13]. Human resources for health play the most significant role in delivering all planned health services in any facility and thus become a key priority to policy makers [14]. It is therefore necessary that they are well sourced, equipped and managed for them to effectively function. They must be in their right numbers, skill mix, right attitudes, skills and competencies and working in the right environment [15–17] to achieve the right health targets for the projected indicators.

Our study findings strengthen similar studies that show inequities in staff distribution even within facilities [18]. We provide evidence on further uses of WISN results in making management decisions such as changing the status or levels of care based on evidence. Our study was conducted to support the LHS administration to plan for the human resources for health requirements for the upgraded hospital from a health centre.

Other results exhibit similar characteristics that have been documented in other countries where CHWs are used to undertake roles that are not their core cadres and tasks are informally shifted and shared without policies to ensure its rationality. This is mainly due to staff shortages [19, 20]. The need for formalizing task shifting/sharing in situations of scarcity such as where medical officers, nursing officers and midwives are scarce is critical. The need for a task shifting and sharing policy with guidelines to ensure quality of services is important. Capacity building of these staff should be provided and
continuous supervision to ensure tasks for the new roles are effectively provided is emphasized [20, 21].

The results provide evidence that calls upon the health managers in PNG to review the role of community health workers in the health facilities. The work they undertake in the facility is far beyond their training and they tend to be easily translated into any cadre where need arises. Moreover, Braun District hospital is located in an island with no health facilities nearby thus the need for releasing the community health workers to undertake their core roles at the household levels with promotive, preventive and rehabilitative services as necessary.

Multitasking was reported among the non-clinical staff. Multitasking can have detrimental effects on task performance and increase errors. Conducting more than one task together may affect performance and increase cost in terms of decreased accuracy [22, 23] and increased reaction time to environmental stimuli [24]. Experimental studies have typically investigated this by presenting two tasks in close proximity and observing the participant’s response to both. Some of the tasks do not require full-time staff but rather outsourcing when such services are needed like the electrician and the painter. These are not activities to be conducted on daily basis. Likewise, for clinical service, multitasking has effects on the quality and time taken to conduct the task. Increasing the time between the first and the second task reduces the delay in responding to the second task. Voluntarily or internally prompted, multitasking has different implications for efficiency and errors than when externally prompted [25].

There is no doubt that the WISN tool provides a scientific method of calculating staff workloads. However, there were limitations encountered during the study. These included under recording of service statistics, the eNHIS does not capture all the tasks provided by the experts but only reports on the key indicators identified for various programmes. This was mitigated by visiting the health facility to collect raw data from the daily registers. Some of the statistics conducted by similar cadres were aggregated and it was a challenge to apportion service statistics to specific cadres and thus a percentage was used.

Conclusion
The results from this WISN study provide evidence for basing various staffing decisions on. Some of the decisions include staff reassignment; some with surplus could mean anticipation of more clients considering the facility change of status as well staff prioritization for hiring. WISN method is an important methodology to help managers make important decisions such as changing the status of a facility like in this study; from a health centre to a district hospital.

Abbreviations
AWT: Available working time; CHWs: Community health workers; HEO: Health extension officer; PNG: Papua New Guinea; eNHIS: Electronic National Health information systems; WISN: Workload indicators of staffing need; LHS: Lutheran health services.

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Authors’ contributions
DD and MO conceived the idea. NM, MTA, TA, GTP, VJL, RJ, and PK conducted the field visit and collected the data. MO, DD, NM, MTA analysed the data and produced the draft report. DL, AM, KY, RM and D reviewed the draft and produced a final document. All authors read and approved the final manuscript.

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Availability of data and materials
Data and materials are available on request from NDoH and LHS report.

Declarations
Ethics approval and consent to participate
The NDoH endorsed the WISN methodology for all staffing requirements estimation and projections in 2017 thus all ethical approvals were waived by the NDoH. The LHS in conformance requested the implementation of the WISN methodology to support the estimation of staffing levels in the newly upgraded hospital. Explanation on the need for the study was explained to the staff to ensure their participation.

Consent to publication
Not applicable.

Competing interests
All authors declare no competing interests.

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