



Public Health Wales Screening Division

Consideration of Potential to Introduce Artificial Intelligence into Screening Workflows

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General Overview of Screening Division

Public Health Wales NHS Trust (PHW) is committed to 'Working to achieve a healthier future for Wales'. As part of this vision, PHW is committed to providing population-based screening programmes in line with Welsh Government policy. The policy for the screening programmes take into account recommendations from the UK National Screening Committee which are considered for approval at the Wales Screening Committee.

The Screening Division within PHW currently delivers the following population based screening programmes on an All Wales basis;

- Abdominal Aortic Aneurysm Screening Wales
- Bowel Screening Wales
- Breast Test Wales
- Cervical Screening Wales
- Diabetic Eye Screening Wales
- Maternal and Child Screening
 - Antenatal Screening Wales
 - Newborn Hearing Screening Wales
 - Newborn Bloodspot Screening Wales

In general terms, the Screening Division is interested in exploring Artificial Intelligence (AI) and considering how the emerging technology can help to support and improve the service offering. This is particularly the case for the breast cancer and diabetic eye screening programmes who are currently facing challenges relating to increased demand and reduced capacity due to workforce challenges.

Breast Test Wales (BTW)

Purpose of BTW

The aim of the breast screening programme is to reduce mortality from breast cancer in Wales.

Breast Test Wales was established in 1988 to:

- provide the national breast screening programme throughout Wales;
- carry out quality assurance of the programme;
- train staff to the standards required to deliver the programme;
- evaluate the programme and carry out research.

Breast Test Wales is **not** responsible for:

- symptomatic mammography;
- treatment and surveillance following diagnosis.

Overview of BTW Workflow and Service Demand

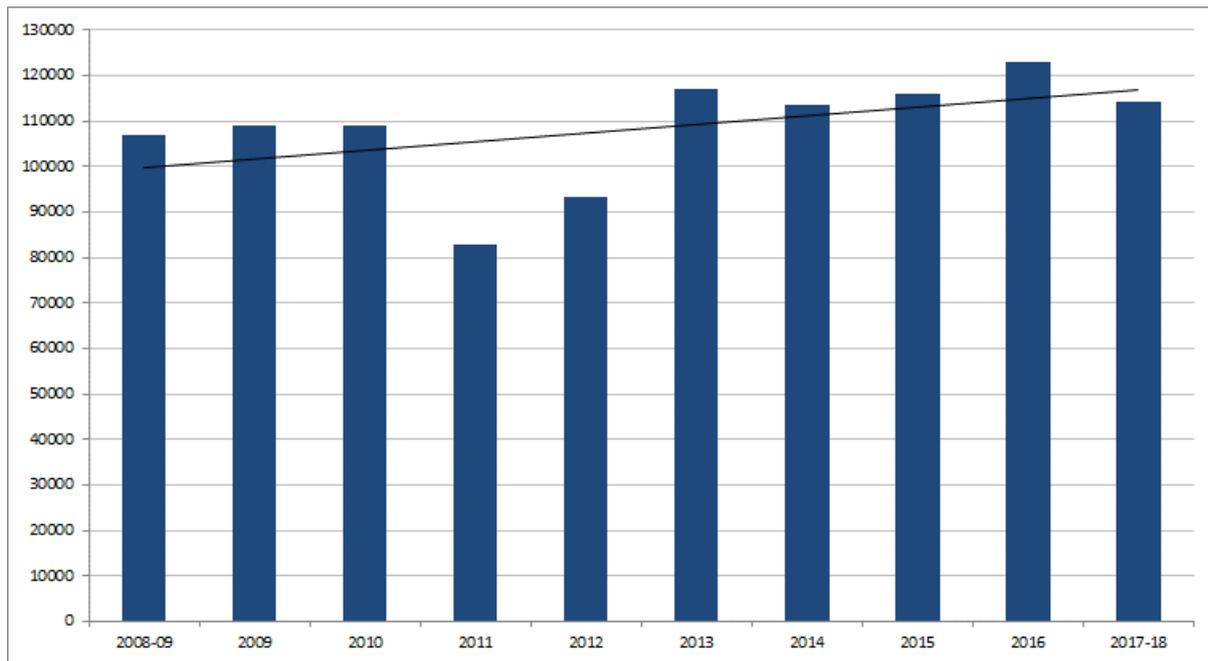
Women aged 50 to 70 who are resident in Wales, and registered with a General Practitioner, are invited for a mammogram (X-ray of the breasts) every three years.

Breast Test Wales is divided into three geographical divisions with centres in Cardiff, Swansea, Llandudno and Wrexham. Eleven mobile units work across Wales to provide local screening to women who live some distance from a centre, visiting over 100 sites in every three year round of screening

All images are double read, with arbitration by a third reader where cancer is suspected. Women with suspicion of malignancy are invited to return for assessment, which is carried out by a team including breast radiologist, breast surgeon, radiographer and breast care nurse.

The role of the increasingly scarce breast radiologist extends beyond diagnosis in many cases. Women with impalpable tumours (the majority of screen-detected cancers, and a smaller proportion of symptomatic disease) require a guidewire to be inserted preoperatively to guide the surgeon to the correct tissue to excise.

The below table describes Breast Test Wales' activity in the 10 years between 2008/9 until 2017/8. It should be noted that activity was low for 2011-3 as a result of the phased suspension of the programme to install digital mammography equipment.



Future demand for breast screening radiology can be predicted from population projections. Assuming no change in the invited age range or frequency of invitation, the population eligible for screening will remain fairly stable, increasing slightly from 412,481 in 2012 to 436,446 by 2023. The programme invites each woman every three years, and invited 137,493 women in 2012, of whom around 70% attended for screening.

BTW is concentrating efforts on improving participation in the programme, and it is possible that this will increase demand to some extent.

Each woman screened receives a minimum of four mammograms which are double read, and approximately 5% recalled for triple assessment, of whom approximately 20% are diagnosed with cancer and referred for treatment. Currently, BTW requires approximately 5,000 assessment appointments throughout Wales and diagnoses around 1,000 cancers.

By 2023, with no change in screening age range or uptake, an additional 300 assessment appointments will be required and an additional 60 cancers will be diagnosed each year. If uptake were to rise to 80%, 1,000 additional assessments would be required per year compared with 2012, and an additional 200 cancers would be diagnosed.

Although the current projected demand for breast screening radiology is fairly static, the NHS Breast Screening Programme in England is conducting a large Randomised Controlled trial of the effectiveness of expanding the age range invited for screening to include women aged 47-73. If the results are positive, and the age range is expanded in Wales accordingly, breast screening activity will increase by around one-third, as shown in table 2.

Potential BTW Opportunities for Artificial Intelligence

BTW consider that opportunities may exist to introduce AI into screening to improve workflows. Specifically, AI could be introduced at either first or second read of the breast screen image, or to assist the arbitration process in the event that 1st and 2nd reads do not concur. There may also be potential for AI to contribute to the quality assurance process.

BTW Data Sets

BTW utilises a Picture Archive and Communication System (PACS) to store digital x-ray images for the screened population. This now includes 3 rounds of images since the introduction of digital imaging into the programme. Outcome data is also recorded on the Welsh NBSS system.

BTW Statistical Information

The latest published Statistical Analysis Report 2017/18 for BTW can be found online here – <http://www.breasttestwales.wales.nhs.uk/sitesplus/documents/1025/Breast%20Test%20Wales%20Official%20Statistics%20Report%202017-2018%20V1.pdf>

Diabetic Eye Screening Wales (DESW)

Purpose of DESW

Diabetic Eye Screening Wales (previously Diabetic Retinopathy Screening Service for Wales) was initially commissioned as a national service by Welsh Government in July 2002. Diabetic Eye Screening Wales became operational in June 2003 and by 2004 was delivering a service to patients in all Health Board areas. The service was initially hosted by Cardiff and Vale Health Board until 2006 when it transferred to join the other population based all Wales Screening Programmes delivered by Public Health Wales.

The service aims to detect diabetic retinopathy before sight loss occurs. Research evidence shows that with early identification and treatment, loss of vision can be prevented in 70 – 90% of people with sight threatening diabetic retinopathy.

DESW is the only life-long UK screening programme. All people aged 12 and over with a diagnosis of diabetes, registered with a GP in Wales, are eligible for regular retinal screening with DESW.

From April 2016 the Welsh Government has given responsibility to the Screening Division of Public Health Wales NHS Trust for all aspects of the diabetic eye screening programme provided to the eligible population resident in Wales, including:

- programme management and coordination;
- call and recall arrangements;
- test processing and results reporting
- face to face screening clinic delivery including image capture
- image processing and results reporting
- evaluation
- performance management and quality assurance

Health Boards have retained the statutory responsibility for the continued delivery of the assessment and ongoing care of patients referred by the screening programme.

Overview of DESW Workflow and Challenges

People aged 12 years and older with a diagnosis of diabetes, who are registered with a GP in Wales, are referred to DESW for regular eye screening.

- Eligible people are invited for eye screening in over 130 community venues across Wales, such as hospitals, health centres, GP practices, or a DESW mobile unit.
- Participants will have a short consultation with a DESW Health Care Assistant. After a check of visual acuity (eye chart), eye drops are administered to make pupils bigger.
- After around a 20 minute wait for the eye drops to work, the photographer will take photographs of the back of the eyes using a special camera. The appointment will then be over.
- The images will be graded to identify whether there is any sight threatening diabetic retinopathy present, and the severity of this.

- Letters containing the screening results and explaining the next steps are sent to all participants:
 - Where there is no retinopathy, or only a limited amount of background retinopathy present, the participant will be re-invited for screening by DESW in around 12 months.
 - Where there is more extensive retinopathy, or if the most sensitive part of the eye (the macular) is affected, the participant may be re-called for DESW screening in 6 months to monitor their condition (surveillance), or referred to their local hospital Ophthalmology Department for specialist assessment
 - If the participant is pregnant, they will be re-called in 3 months, regardless of whether any retinopathy is present.

The DESW service invites approximately 174,000 participants for screening annually. However, the growth in demand is linked to the increasing prevalence of diabetes within the Welsh population. This results in approx. 1000 new participants entering the programme each month and has contributed to ongoing workforce and timeliness challenges in the service.

The screening programme is currently engaged in a comprehensive optimisation and transformation project designed to ensure high quality, quality assured, person centred timely screening can be offered on a sustainable basis into the future

Potential DESW Opportunities for Artificial Intelligence

DESW consider that opportunities may exist to introduce AI into screening to improve timeliness and workflows. Specifically, AI could be introduced at either first read of retinal image, second read of retinal image or as part of the quality assurance process.

DESW Data Set

DESW holds digital images for all programme participants along with the relevant screening outcome data.

DESW Statistical Information

The latest published Statistical Annual Report for DESW relating to 2017/18 can be found online here –

<http://www.wales.nhs.uk/sitesplus/documents/888/Diabetic%20Eye%20Screening%20Wales%20Annual%20Statistical%20Report%202017-181.pdf>