Institution: Sheffield Hallam University		
Unit of Assessment: UOA03 - Allied Health Professions, Dentistry, Nursing and Pharmacy		
Title of case study: Improving Breast Cancer Outcomes in Older Patients		
Period when the underpinning research was undertaken: January 2013 - December 2020		
Details of staff conducting the underpinning research from the submitting unit:		
Name(s):	**Role(s) (e.g. job title):**	**Period(s) employed by submitting HEI:**
Dr Maria Burton: Professor Karen Collins	Principal Lecturer Professor of Health Sciences	November 1995 - current September 2008 - May 2018
Period when the claimed impact occurred: November 2019 - December 2020		
Is this case study continued from a case study submitted in 2014? No		

1. Summary of the impact

Older women with breast cancer have poorer outcomes than younger women, partly due to the non-standard treatment they receive. As there is little to guide older patients or clinicians when faced with a treatment choice, decisions are often based on personal preference, rather than being evidence-based. Sheffield Hallam research developed a decision support intervention (DESI) to guide optimal, personalised treatment for older women with certain breast cancers. This led to: changes in clinical practice and treatment received, improved patient knowledge, greater shared decision-making, enhanced quality of life and a sense of empowerment. The DESI has benefitted both clinicians and older women with breast cancer. The DESI quickly achieved global reach, having been used by clinicians on all six continents.

2. Underpinning research

The standard treatment for women with oestrogen sensitive breast cancer is surgery plus endocrine therapy. However, there is a group of women - those aged 70 and older with - for whom there is an undetermined difference in treatment outcome, whether they have surgery plus endocrine therapy, or primary endocrine therapy alone. These are likely to be women who are older, less fit or frail, and with a life expectancy of 2-3 years. This is largely due to the lack of women in this age group in clinical trials. In this scenario the choice of treatment is often one of personal preference. Women ≥70 years of age with breast cancer are consequently less likely to receive surgery (standard treatment), which may contribute to the inferior outcomes. Since there is little research to guide best practice or support treatment decision-making, there is wide variation in treatment across cancer units.

Lack of evidence-based guidance is a significant issue, as there are 2 million cases of breast cancer globally (WHO 2018) and 55,000 new cases annually in the UK, with 13,000 in women over 75 years of age (Breast Cancer UK 2020). Sheffield Hallam's Age Gap study identified and calculated the key elements which allow prediction of outcome in this group of women. The Age Gap study particularly responded to challenges set to: i) address this wide variation in treatment (*Breast Cancer Clinical Outcome Measures*, 2007) and, ii) improve patients' treatment information and shared decision-making (*Equity and Excellence: Liberating the NHS*, Department of Health, 2010).

The Age Gap study was a GBP1,900,000 NIHR-funded programme collaboration between the universities of Sheffield, Sheffield Hallam and Cardiff. The Sheffield Hallam team comprised Professor Karen Collins and Dr Maria Burton. Professor Collins was key in the development of the proposal and a co-applicant. She has extensive expertise in cancer research and public and patient involvement in health research (retired May 2018). Dr Burton is a senior researcher, with

significant experience of qualitative and mixed methods research with older adults, who has remained with the study since its inception. The Sheffield Hallam team were responsible for all the underpinning qualitative elements of the DESI development, for user training and implementation in the randomised controlled trial (RCT), and for the planning, execution and analysis of the concurrent process evaluation. The study had two phases:

Phase one consisted of a multi-centre cohort study that recruited 3,375 women (≥70) with operable breast cancer from 56 sites across the UK (**R1**). The aims were to: i) determine the patient and cancer characteristics which predict whether primary endocrine therapy is safe and effective in breast cancer treatment, and ii) produce a DESI to support shared treatment decision making.

The DESI was developed to support the choice between surgery and endocrine therapy, and primary endocrine therapy. It consists of a brief decision aid (a summary of frequently asked questions), a booklet about treatment choices, and a clinician-facing online treatment decision tool.

Online tools exist to support decision-making in cancer (e.g. NHS PREDICT and Adjuvant On-Line), but no tool existed where there was a choice of surgery and endocrine therapy, or primary endocrine therapy alone. The Age Gap DESI was rigorously developed using cancer registry data, an evidence synthesis to understand the information needs of older women, and with input from 46 patients, 14 healthy volunteers and 25 clinicians (**R2**, **R3**, **R4**). The Age Gap DESI is unique, as it is underpinned by data solely from women ≥70.

The online tool allows prediction of survival outcomes, stratified by age, co-morbidity and frailty, depending on the type of treatment the woman receives (freely available at https://agegap.shef.ac.uk/). It also produces personalised patient survival estimates for differing treatments, providing the ability to calculate individually-tailored decisions about treatments.

Phase two was a cluster randomised controlled trial (cRCT) that tested the impact of the DESI on treatment decisions (**R5**). To understand how the intervention worked in clinical practice, a process evaluation was also undertaken. The aims of the cRCT were to test whether the DESI would improve: i) quality of life (QoL) and ultimately the cancer outcomes, and ii) the treatment decision-making experience of older women with breast cancer, in line with the *NHS Long Term Plan*.

46 breast units were randomised (21 intervention, 25 control) and recruited 1,339 women (670 intervention, 669 control). Clinicians and patients reported benefits of using the DESI, specifically enhanced information and knowledge leading to altered treatment choice, and increased confidence and involvement in discussion and decision-making (**R5**).

The Age Gap study was the first of its kind in the world and has provided evidence and tools to address the need for improved cancer outcomes and shared decision-making, identified in the *NHS Long Term Plan*, the *NHS Constitution*, and *Achieving World-Class Cancer Outcomes: A Strategy for England 2015-2020*. The scale, design and rigour of the study led to the collection of high-quality data from over 3300 older women, something previously shown to be unachievable (**R6**), enabling the online tool to be registered with the Medicines and Healthcare products Regulatory Agency (MHRA).

3. References to the research

R1. Wyld L, Reed MWR, Morgan J, **Collins K**, …., **Burton M**, … Thomson AM (2021; Epub 18/11/20). Bridging the Age Gap in Breast Cancer. Impacts of Omission of Breast Cancer Surgery in Older Women with Oestrogen Receptor Positive Early Breast Cancer. A Risk Stratified Analysis of Survival Outcomes and Quality of Life. *European Journal of Cancer*. 142(12):48-62. https://doi.org/10.1016/j.ejca.2020.10.015

R2. Ward SE, Holmes GR, Morgan JL, Broggio JW, **Collins K**, Richards PD, Reed MW, Wyld L (2020). Bridging the Age Gap: A Prognostic Model that Predicts Survival and Aids in Primary Treatment Decisions for Older Women with Oestrogen Receptor-Positive Early Breast Cancer. *British Journal of Surgery*. 107:1625-32. https://doi.org/10.1002/bjs.11748

R3. **Burton M**, Collins KA, Lifford KJ, Brain K, Wyld L, Caldon L, Gath J, Revell D, Reed MW (2015). The Information and Decision Support Needs of Older Women (>75 yrs) Facing Treatment Choices for Breast Cancer: A Qualitative Study. *Psycho-Oncology*. 24(8):878-84. https://doi.org/10.1002/pon.3735

R4. Lifford KJ, Edwards A, **Burton M**, Harder H, Armitage F, Morgan JL, Caldon L, Balachandran K, Ring A, **Collins K**, Reed M (2019). Efficient Development and Usability Testing of Decision Support Interventions for Older Women with Breast Cancer. *Patient Preference and Adherence*. 13:131-43. https://doi.org/10.2147/ppa.s178347

R5. Wyld L, Reed MW, **Collins K**, **Burton M**, …. Thomson A (2021; REF2 includes Covid delay statement). Bridging the Age Gap in Breast Cancer: Cluster Randomised Trial of the Effects of Two Decision Support Interventions for Older Women with Operable Breast Cancer on Quality-of-Life, Survival, Decision-Quality and Treatment Choices. *British Journal of Surgery*. Available on request.

R6. Todd A, Martin C, Morgan J, Herbert E, Bradburn M, **Burton M**, Reed MW, Chater T, Pemberton K, Walters S, Cheung KL (2020). Age Specific Recruitment and Retention to a Large Multicentre Observational Breast Cancer Trial in Older Women: The Age Gap Trial. *Journal of Geriatric Oncology*. https://doi.org/10.1016/j.jgo.2020.10.015

All articles underwent rigorous peer-review and are published in leading journals in the field.

4. Details of the impact

Global Usage of the Age Gap DESI

Since becoming available in November 2019, the clinician-facing online tool has been used increasingly at cancer treatment sites across the world. Figures to December 2020 show 10,257 accesses (Figure 1), across 449 cities, in 69 countries, and all six continents. To-date the greatest uptake is in Europe (56.3%), followed by North America (28%), Asia (10.6%), with Africa, Oceania and South America 3.8% collectively (Figure 2). Of the 10,257 accesses, it was used on 7,571 occasions to calculate outcomes for surgery and endocrine therapy, or primary endocrine therapy alone; and 2,382 to calculate outcomes for surgery and chemotherapy, or surgery and no chemotherapy; demonstrating the immediate value of the tool to clinicians. On 304 occasions the information was also printed out for patients' use; although the tool can produce a leaflet demonstrating the outcomes for the patients, clinicians are selective about which patients this would be most appropriate for. (**E1**, **E2**)

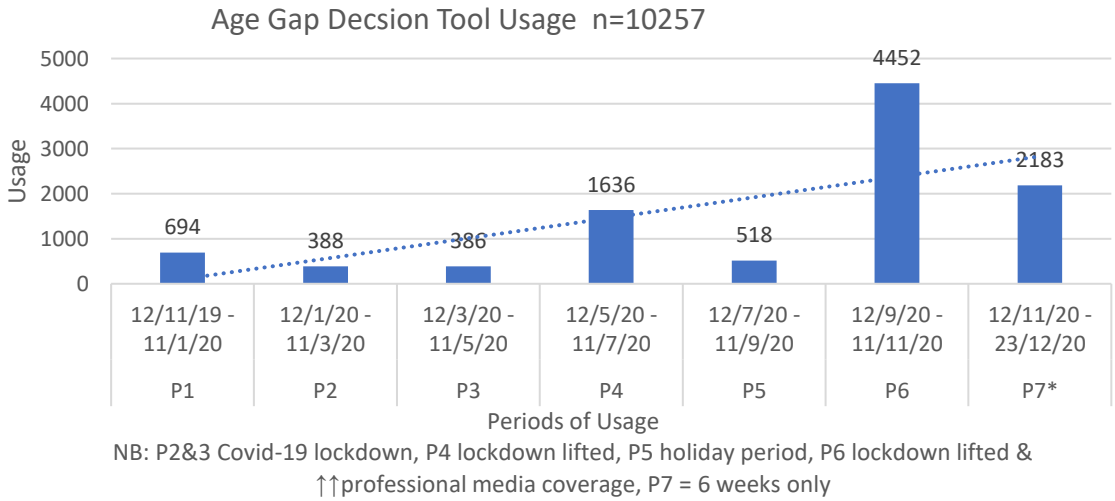

Figure 1: Three-monthly usage of the Age Gap DESI, from its launch to Dec 2020

Figure 1 illustrates an upward trajectory in use of the tool, but also how the Covid-19 pandemic affected its use. Following submission of the final study report in July 2020, and the dissemination

via virtual events, media coverage grew significantly (**E3**), leading to an upsurge in clinician usage in Period 6 (Figure 1; note P7 is half the duration of the other periods).

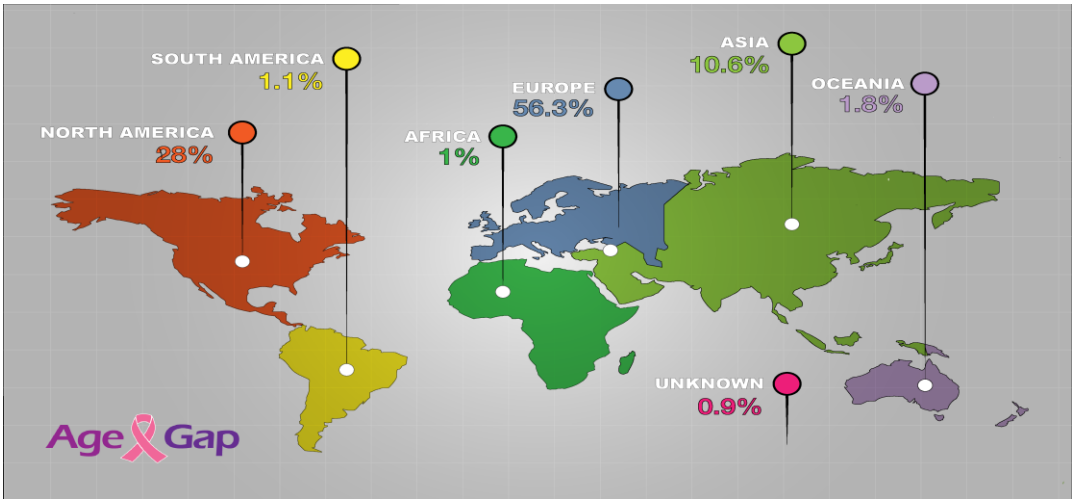

Figure 2: Global usage of the Age Gap Tool (Nov 2019-Dec 2020)

Change in Clinical Practice

Following the introduction of the DESI, clinicians - predominantly surgeons - reported a change in clinical decision-making and practice (**E4**). Prior to the tool being available, the treatment was largely based on clinician preference, with age shown to be an independent factor in that decision, contrary to the NICE guidelines (CG80).

The tool demonstrated to the surgeons that in some patients, primary endocrine therapy could be more beneficial than surgery, and vice-versa. The survival figures calculated by the tool, were sometimes unexpected and, when faced with this, they were forced to rethink the appropriateness of their usual management: *"When I look at the two [treatment options]… it says... there's hardly a two or three percent difference, but when I look at the graphs... [it] sways me one way or the other... In a lot of patients that I would have thought that they must have been better off with surgery, the tool swayed me… and also the patients; so it has changed in my practice."* (Consultant Oncoplastic Breast Surgeon, Participant 2) (**E4**)

> "W*hereas previously [prior to the tool] I would have just said, I think you should have an operation. So, I think in that respect it's probably meant that I would have the discussion with more people about endocrine therapy, [rather] than just surgery…. I'm certainly having a better discussion with the patients."* (Consultant Surgeon, Participant 5) (**E4**)

Clinicians were pleased to have evidence-based information, presented as numbers, as this supported their data-led preferences: *"It has [impacted on own clinical decision-making] because now I have got something that I can solidly… tell somebody."* (Consultant Breast Surgeon, Participant 4) (**E4**)

The graphical representation of the outcomes was clear and provided a common platform to discuss treatment selection with the patient and/or families/carers. This had the effect of changing the dynamic of the consultation. Clinicians thought that information from the DESI gave the patient confidence to engage in the decision-making process and feel more content with their treatment decision. This encouraged their continued use of the DESI: *"I think that the... interventions [have] been really good at… empowering patients and helping them make a decision, and we've felt that patients are much more part of the decision making."* (Consultant Breast Surgeon, Participant 4) (**E4**)

The DESI is not only changing practice, it is also influencing the education of clinicians - it has been included in the *Communicating Evidence to Patients* course run by University of Cambridge's

Winton Centre for Risk and Evidence Communication as an example of good practice. https://moodle.wintoncentre.uk/ (**E5**)

Impact on Patient Experience

Patients interviewed said they felt involved in the decision-making process, stating that the combination of information formats, i.e. the written and the numeric information, helped them more fully understand the options and possible outcomes, and had given them the confidence and knowledge to engage in the consultation. (**E4**)

This sense of greater shared decision-making from the patients' point of view was confirmed by high scores in CollboRATE, a validated measure of this, and was further supported by a bespoke questionnaire to assess knowledge of treatment options, which similarly demonstrated improved scores (**E6**). These patient experiences are entirely consistent with those of clinicians, suggesting that both were being assisted to make better informed decisions about treatments, upon which they agreed. Patients also found the written information prompted further questions, which they raised during future consultations. Some described how this helped them cope with the treatment journey, as they understood the process and what to expect: *"I thought [the sheet] was very good... I've always thought it's good to be able to read these things and see what they think. [It] gives you a good idea what's happening, because sometimes people, you know, they seem to clam up, saying the big C and oh, oh. Silence! But...I don't believe in that."* (82 year-old surgery patient) (**E4**)

The evidence of these impacts supports the plans of the NHS *Five Year Forward View* (2014) and the NICE *Shared Decision-Making Collaborative - An Action Plan* (2016), which commit to empower patients by providing up-to-date information about the possible treatments - to enable them to make more informed decisions. It can also be viewed as a practical step towards nurturing a culture of shared decision-making - by providing tailored, patient friendly information to facilitate informed patient choice, as highlighted in the Macmillan report *Cancer in the UK 2014: State of the Nation*. In short, the DESI helped to bring about long-awaited relational improvements between clinicians and a vulnerable group of older patients, marking an important shift towards an inclusive culture of decision-making, at a critical time in the life course of these women.

The capability for the Age Gap Tool© to impact on the treatment and on the experience of older women with breast cancer has been recognised by Professor Riccardo Audisio (University of Gothenburg) who tweeted (28/1/20): "*There is no doubt that the @AgeGapStudy will contribute to bringing to an end the under treatment of older women with breast cancer."*

5. Sources to corroborate the impact

E1 Raw data and analysis demonstrating reach and use of the Age Gap decision tool

E2. Analysis of use of the Age Gap Tool by type

E3. Media coverage linked to use of the Age Gap Tool

E4. Quotes and interview transcripts demonstrating change in clinical practice and the impact on patient experience

E5. Evidence of use in clinical education

E6. Patient feedback data demonstrating the impact on shared decision making and discussion about treatment options