Impact case study (REF3)

Institution: Aston University

Unit of Assessment: 11. Computer Science and Informatics

Title of case study: The Galatean Risk and Safety Technology, GRiST: a web-based system for collaborative mental-health assessment and management

Period when the underpinning research was undertaken: 2000 - present

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 Christopher Buckingham	Reader in Computer Science	2000 – present

Period when the claimed impact occurred: 1/8/13 to 31/12/2000

Is this case study continued from a case study submitted in 2014? No

1. Summary of the impact

GRiST is a mental-health clinical decision support system (DSS) delivered by Aston as a cloud-computing service. It is used around the clock by NHS, charity and private hospital practitioners to assess and manage risks associated with mental-health problems, including suicide, self-harm, harm to others, self-neglect and vulnerability. 5,879 practitioners have registered 126,305 new patients with GRiST and completed 367,047 risk assessments, including over 1.5 million separate risk evaluations. GRiST has changed organisational and clinical processes through its systematic collection of risk information and associated clinical risk judgements. Machine-learning predictions validate the judgements and help GRiST's principled risk formulations generate appropriate management plans.

2. Underpinning research

One in six people suffer mental health problems at any moment in time (Public Health England, 2019). In the UK, there are almost nine suicides per 100,000 (and many more attempts) making it the second-highest cause of death in people aged 15 to 29. Assessing the risks requires specialist training and current risk-assessment tools collect unstructured data that are difficult to analyse and share by machines. GRiST is a new approach conceived and developed by **Buckingham** at Aston. It emerged from his research into interpreting clinical decision-making as three linked, iterative classification tasks: diagnosing; assessing potential outcomes; and making intervention decisions **[R1]**. Concurrently, **Buckingham** showed how his "Galatean" model of psychological classification **[R2]** can be used to capture mental-health practitioners' knowledge and reasoning processes. The two research strands were integrated to build a formal model of risk assessment expertise **[R3]** and put it at the heart of a mental-health web-based Decision Support System (DSS), GRiST (www.egrist.org), that communicates data, risk levels, and appropriate advice **[R4]**.

A series of grants **[e.g. G3, G5]** enabled the psychological underpinnings of GRiST to elicit clinical expertise in a format that end users could fully understand and apply across different assessment contexts **[R4]**, including versions for people without mental-health expertise **[R5]**. The result is a unique, machine-processable model of mental-health risks and machine learning advice **[R6]** that directly led to research impact via its incremental deployment within the GRiST DSS.

GRiST's web-based system [www.egrist.org/try-grist] helps clinicians: (i) collect and record relevant risk data for particular patients and assessment circumstances; (ii) see how the data contribute to risk evaluations; (iii) benchmark their judgements against thousands of mental-health colleagues and the 1.5 million risk judgements they have made [GRiST database]; and (iv) identify where patients need help. It motivated national **[e.g. G2,G5]** and international **[e.g. G3,G4,G6]** research funding that ensured GRiST works right across the care pathway, from

people living in the community – e.g. Improving Access to Psychological Therapies (IAPT), independent living villages – to specialist secondary-care services – e.g. forensic and learning disabilities. US funding **[G6]** enabled **Buckingham** to explore suicide causes by analysing GRiST records and serious incident reports that led to the implementation of risk formulations. A US/UK collaborative grant **[G8]** came out of the GRiST research to explore health inequalities and helped ensure GRiST avoided racial and gender biases.

The generic nature of GRiST's methods and psychological underpinnings enabled the technologies to be applied in different knowledge domains, such as logistics and water-pipe condition assessment. The logistics project **[G7]** applied **Buckingham's** Galatean model to implement shared decision-making between individual transport depots. It subsequently informed the collaborative clinical and self-assessments built into GRiST **[R5]** that empowers people to co-create their own health, as advocated by Government policy (e.g. DHSS, 2018: the future of healthcare).

3. References to the research

R1 Buckingham, C. D. & Adams, A. E. (2000). Classifying clinical decision making: A unifying approach. *Journal of Advanced Nursing*, 32(4), 981-989, https://doi.org/10.1046/j.1365-2648.2000.t01-1-01565.x

R2 Buckingham, C. D. (2002). Psychological cue use and implications for a clinical decision support system. *Medical Informatics and the Internet in Medicine*, 27(4), 237-251, https://doi.org/10.1080/1463923031000063342

R3 Buckingham, C. D., Adams, A. E., & Mace, C. (2008). Cues and knowledge structures used by mental- health professionals when making risk assessments. *Journal of Mental Health*, 17(3), 299–314, https://doi.org/10.1080/09638230701498374

R4 Buckingham, C.D., Ahmed, A., & Adams, A. (2013). Designing multiple user perspectives and functionality for clinical decision support systems. In *Proceedings of the 2013 Federated Conference on Computer Science and Information Systems (FedCSIS)*, pp 211-218, IEEE Xplore, https://publications.aston.ac.uk/id/eprint/21302/1/Designing_multiple_user_perspectives_and_functionality_for_clinical_decision_support_systems.pdf

R5 Buckingham, C. D., Adams, A., Vail, L., Kumar, A., Ahmed, A., Whelan, A., & Karasouli, E. (2015). Integrating service user and practitioner expertise within a web-based system for collaborative mental-health risk and safety management. *Patient Education and Counseling*, 98(10), 1189–1196, https://doi.org/10.1016/j.pec.2015.08.018

R6 Zaher NA, Buckingham CD. (2016) Moderating the Influence of Current Intention to Improve Suicide Risk Prediction. *AMIA Annu Symp Proc. 2016;2016* 1274-1282. PMID: 28269925; PMCID: PMC5333240, https://www.ncbi.nlm.nih.gov/pubmed/28269925

Peer-reviewed grants, G, providing evidence of research quality (most recent first)

G1 ICURe (2020): £28,742.75: ``eGRiST''. Project Reference: Mid-F-16.

G2 Knowledge Transfer Partnership: £196,599: "Using machine learning to improve mental health in the workplace'', https://lumien.io/

G3 European Commission EIT Health KIC: (1/2/2016-31/1/2019, £788,970): "Self-management of mental health and wellbeing in the community for older adults".

G4 Erasmus+ KA2 (2016-19) £345,092: "GRANDIS XXI: Vocational Education for Interprofessional Elderly Care of the 21st century", https://www.grandis21.hu/.

G5 Health Foundation (2014-15) £39,288: "Developing the myGRiST personal safety and mental-health risk assessment computer decision support system for patients and carers".

G6 American Foundation for the Prevention of Suicide: (2013-15) £44,403: "Improving clinical evaluations of suicide risk and their relationship to care planning".

G7 EU FP7-ICT-2009-5 (2010-13), £1,525,834: "ADVANCE: Advanced predictive-analysis-based decision-support engine for logistics".

G8 ESRC-UK and NIH-USA, Johns Hopkins University, (2010-15) £624,000: "Understanding Social Contributions to Disparities in Depression Care: US and UK".

4. Details of the impact

GRiST [www.egrist.org] changes practice by formalising data collection, visualising where risks originate, analysing and displaying risks over time, enabling customised risk reports, and comparing individual risk judgements with expert consensus to improve accuracy and highlight potential errors. Impact is integral to the research process as clinician and user involvement was written into grants **[e.g. G3,G5]**.

GRiST usage: 5,879 mental-health practitioners have used GRiST 436 times a day on average to register 126,305 new patients, complete 367,047 risk assessments, including over 1.5 million separate risk judgements, and review patients' reports [GRiST database]. GRiST has been used in seven secondary care NHS organisations, eight primary and community care services, and 19 private healthcare organisations and charities [www.egrist.org/sponsors].

GRiST shared decision-making: GRiST's potential for shared decision-making and collaborative care was recognised by the Health Foundation **[G5]** and Horizon2020 **[G3]**. Development of the new self-assessment version – myGRiST – was an international collaboration **[G3]** with technology for translating into any language. Dutch was used by KU Leuven for older adult evaluation **[E1]** and Portuguese for child and adolescent risk evaluations **[E5]**. The new myGRiST assesses workplace mental health in the SURFWELL programme, run by Devon and Cornwall Police **[E2]**, and in Evolyst's grant-funded Lumien project **[G2]**. Linking GRiST with sensors that monitor people at home led to collaborations with ExtraCare retirement villages, and an international sensor company, RedGear **[E3]**.

Improving clinical practice: GRiST's expanding dataset is one of only four identified UK specialist mental-health datasets **[E4]**. Its analysis of mental-health clinicians' risk judgements **[R6]** feeds into practice through the GRiST DSS, generating international interest. Examples include: Portuguese mental-health training using GRiST **[E5]**; a Walden University (USA) doctoral study, where "*the screening tool that would guide the development … was the GRiST tool*" and "*Monies have been budgeted for the cost of the GRiST software*" **[E6]**; a collaboration with European academic and technology organisations **[G3]**; and funding from the American Foundation for Suicide Prevention which said: "*We are so happy to have helped you complete important work in the field of suicide prevention*" **[G6, email to Buckingham]**. GRiST also improved management plans by linking assessments to them via risk formulations: "*GRIST has provided a solution that has worked much better than previous risk assessment tools utilised in the Trust. It supported structured risk assessments and the development [of] formulations and safety plans*" **[E7]**.

Care Quality Commission (CQC) reports evidence impact. Examples include Humber NHS Trust: "*We found thorough risk assessments on the case files we reviewed in the CAMHS teams using GRIST. These were completed to aid the planning and delivery of support and intervention.*" **[E8]**; and Imagine Independence: "*Any incidents were recorded and monitored immediately using the GRIST tool, which enabled staff to monitor risk and revise support plans, reviewing the level of risk on a daily basis*" **[E8]**. CQC reports show GRiST supports shared and person-centred risk assessment and management **[E8]**. Examples include Mental Health Concern: "*GRIST… provided information on how individual risks were changing and any improvement to the risk to assist recovery. Staff worked in partnership with people and they provided one-to-one support meetings with the person to try to alleviate the risk*" **[E8]**. Similar reports relate to young-person's GRiST assessments. Durham County Council's website states the use of GRiST for improving quality assurance systems (https://www.durham.gov.uk/article/21413/Specialist-services), and its collaborative role is confirmed by an OFSTED report: "*Case managers ensure that children's risk assessments and risk management plans incorporate all known and potential risks. They work with children to help them to understand how their emotions and frustrations may increase these risks*" **[E9]**.

***Training and awareness:* Buckingham** has trained hundreds of practitioners on GRiST (e.g. 184 from six organisations in 2018) and an independent company uses GRiST in its mental health training **[E10]**. A Brussels GRiST presentation led to an EU Erasmus project [G4], training older adults and their carers in IT for independent living. GRiST workshops were attended by mental-health practitioners and users nationally (e.g. Meridian IAPT conference, 2019; Oxford University, 2016 and 2015; National Information Board, 2016; British Science Festival, 2014) and internationally (e.g. Vienna, 2017; Health Informatics Society, Dublin, 2017; Amsterdam EACH conference, 2014) [www.egrist.org/news]. A KU Leuven ATHENS module (www.athensprogramme.com) included GRiST, with 29 students attending from 9 different universities across Europe in 2018 [https://www.egrist.org/node/611].

Economic impacts: GRiST is linked to several patient record systems: IAPTus (https://iaptus.co.uk/) , which supports most primary care IAPT services; Carenotes (https://www.oneadvanced.com/solutions/carenotes/) and RiO (https://www.servelec.co.uk/product-range/rio-epr-system/) in secondary care; and Salesforce via Sandyx (https://www.sandyx.com/aboutus/) in community care. Private and charitable organisations using GRiST's patient record system improve market strength by having a validated risk and safety system, with GRiST regularly featuring positively in quality evaluations [E8, E9]. GRiST directly generates income from licence to use fees (£115,350 in 2019/2020) **[E11]**, spinning out as a separate company: egrist ltd (https://find-and-update.company-information.service.gov.uk/company/11638424). Its commercial viability is shown by winning an ICURe grant and being selected for the second stage where GRiST can pitch for up to 300K from InnovateUK **[G1]**.

5. Sources to corroborate the impact

E1: D'Haeseleer, I., Gerling, K., Vanrumste, B., Schreurs, D., Buckingham, C., & Abeele, V. V. (2019). Uses and attitudes of old and oldest adults towards self-monitoring health systems. Pervasive Health '19: EAI International Conference on Pervasive Computing Technologies for Healthcare. Trento, Italy.

E2: Police Surfwell programme, https://www.surfwell.co.uk/, with egrist shown in the list of collaborators at the bottom of the home page. Role can be confirmed by the founders and project leaders.

E3: RedGear sensors and healthcare (https://www.rgs-care.com/about) with evidence of ExtraCare collaboration from the Director of RGS Care and the CEO of RedGearSolutions.

E4: Stewart, Robert & Davis, Katrina (2016). 'Big data' in mental health research: current status and emerging possibilities. Social Psychiatry and Psychiatric Epidemiology pp1055-1072, 51 (8). https://doi.org/10.1007/s00127-016-1266-8. Table on p1057 lists GRiST as one of 4 specialist mental-health datasets in the UK.

E5: Two linked studies on using GRiST for training in Portugal: André Filipe Fidalgo Maravilha (2014) set up hospital training that was "the starting point for the beginning of the cultural adaptation process of the instrument GRiST" (http://hdl.handle.net/10400.26/16376); and it was used in two later training internships by Ana Margarida Rodrigues Dâmaso (2019).

E6: Nguh, F. A Practice Guideline for Triaging Mental Health Patients in the Emergency Setting. (2019). Walden University, Columbia, US.

E7: Cumbria presentation on GRiST by the Clinical Director of First Step and the Clinical Director of Access and Liaison Integration Service/Home Treatment Team 18/6/2019. Emailed to GRiST.

E8: Care Quality Commission Reports: CAMHS Humber CQC report, 2014; CQC Imagine Independence Fielder Lodge, 2019; Northern Healthcare CQC, 2019; Mental Health Concern CQC, 2018.

E9: Ofsted report, Aycliffe Secure Centre, 2019.

E10: Mental Health Training company, mentalhealthtraining.co.uk, that uses GRiST and can be confirmed by the CEO.

E11: GRiST licence payments from: Worcestershire Health and Care NHS Trust, Mental Health Concern, Cumbria Partnership NHS Trust, Northern Healthcare, Orkney NHS Trust, Birmingham Children's Hospital, Rossie Young People's Trust, Imagine Independence, BenjaminUK, and Aycliffe Secure Centre.