Institution: University of Portsmouth		
Unit of Assessment: UoA3 - Allied Health Professions, Dentistry, Nursing and Pharmacy		
Title of case study: Improved patient health and reduced burden on NHS services through new interventions for chronic respiratory conditions		
Period when the underpinning research was undertaken: 2009 - 31 July 2020		
Details of staff conducting the underpinning research from the submitting unit:		
Name(s):	**Role(s) (e.g. job title):**	**Period employed by submitting HEI:**
Prof Anoop Chauhan	Honorary Professor of Respiratory Medicine	Category C
Dr Carole Fogg	Senior Lecturer	01/06/2009 - 30/09/2018
Mr Bernard Higgins	Senior Lecturer	01/09/1979 - 09/09/2018
Dr Sally Kilburn	Principal Lecturer	01/08/1999 - 31/08/2015
Dr Reuben Ogollah	Lecturer	19/04/2010 - 07/10/2012
Prof David Prytherch	Professor of Health Informatics	23/11/2016 - date
Prof Janis Shute	Professor of Respiratory Pharmacology	01/01/2001 - date
Period when the claimed impact occurred: 2015 - 31 July 2020		
Is this case study continued from a case study submitted in 2014? N		

1. Summary of the impact

Respiratory crisis, such as severe difficulty breathing, occurs when chronic respiratory diseases go undiagnosed or are poorly managed. A series of community-based programmes delivered an entirely new model for the assessment and care of individuals with chronic respiratory symptoms. A multidisciplinary team provided early identification of patients at risk from poorly-controlled disease and upskilled both patient and primary care providers to improve self-management to keep patients better and more independent. This resulted in significant reductions in respiratory crises (37-89%), associated unscheduled hospital admissions (55-100%), medication needs (e.g. halving antibiotic use in asthmatic patients) and associated costs to the NHS (saving between GBP90 and GBP490 per patient). Benefits were long-lasting, with quality of life improved in 75% of patients six months after the MISSION Asthma clinics. Recommended by NICE, our novel, one-stop assessment-and-care approach is now in use nationally and has been successfully applied in other long-term health conditions, including diabetes and dementia.

2. Underpinning research

Over 12,000,000 people in the UK have chronic respiratory conditions resulting in significant, and increasing, mortality and morbidity. The two most common respiratory conditions, asthma and Chronic Obstructive Pulmonary Disease (COPD), cause over 1,400 and 30,000 deaths per year, respectively. As long-term conditions, they present a significant societal and economic burden. Lung disease in the UK costs GBP9,900,000,000 in healthcare and GBP1,200,000,000 in costs to the wider economy. Mortality and financial impacts are related to the incidence of unplanned hospital admissions due to respiratory crises, such as severe difficulty breathing. These crises are attributed to a combination of poor disease management in high-risk patients and there being a large group of patients with undiagnosed and unmanaged conditions.

Research between the University of Portsmouth (UoP), led by **Shute,** and Portsmouth Hospitals University NHS Trust (PHUT), led by **Chauhan** (made Honorary Professor in 2008; Cat. C in this submission), sought to better characterise patients with chronic respiratory conditions in order to improve management of their long-term health and reduce the occurrence of respiratory crises.

In 2009, **Chauhan, Higgins** and **Shute** conducted a pilot study of 30 participants, comparing asthmatics to healthy controls. They identified chemicals within sputum that are specific to severe asthma and underlie an irreversible worsening of asthma, with associated respiratory crises (**R1, G1**). Building on this, in 2011 **Chauhan** and colleagues conducted a much larger (215 participants), multicentre study which identified distinct groupings of asthma patients based on factors including chemicals within sputum (**R2, G2**).

Parallel to the biochemical characterisation of asthma patients and identification of factors underlying respiratory crises, **Chauhan** led a series of studies that highlighted the impact of acute exacerbations on patients and the healthcare system. In 2010, **Chauhan**, **Prytherch**, **Higgins** and **Kilburn** analysed data of 9,915 admissions for acute exacerbations of COPD for a 7-year period. They highlighted previously unknown risks: inpatient mortality was 15.5% (**R3**), with

admissions and associated mortality and morbidity greatest at weekends and in winter (**R4**). In highlighting risks associated with respiratory crises, these studies suggested that better symptom management, required to reduce exacerbations, would reduce mortality and demand on hospitals. In 2014, **Chauhan**, **Fogg** and **Ogollah** developed a new approach to patient management; evaluating whether early intervention by specialists would improve patient and carer quality of life, healthcare utilisation and cost (**R5**, **G3**). Together these studies (**R3-5**) identified the impact of respiratory crises and developed an approach (**R5**) to implement and assess early intervention.

Subsequently, **Chauhan** and colleagues undertook a series of four programmes in community-based settings in Wessex to address the clinical need for a different approach to the management of chronic respiratory conditions. These programmes provided:

1. Proactive, early identification of patients at risk from poorly controlled disease
2. For each patient, an individualised carousel of assessments and reviews by a multidisciplinary team of specialists
3. Effective integration between specialist and primary care
4. Upskilling of both patient and primary care providers to enable better self-management.

The programmes were:

- **MISSION Asthma**: Dec 2014 - Dec 2015; 174 patients recruited.
- **Breathlessness Programme**: Mar 2015 - Sept 2015; 42 patients recruited.
- **MISSION COPD**: Sept 2015 - Spring 2016; 108 patients recruited.
- **MISSION ABC**: Spring 2016 - July 2017; 471 patients recruited.

Suitable participants, including those with undiagnosed respiratory symptoms, were identified using primary care records of ca. 28,000 patients from 10 GP practices. Patients were assessed by a multidisciplinary team, operating carousel-style consultations, with diagnosis made immediately. Biochemical analyses based on previous research (**R1**, **R2**) helped identify patients with severe illness and additional investigations and treatment were instigated for these patients. All patients were followed-up to review compliance with their treatment, evaluate the impact of the treatment, and ensure the patients felt confident managing the condition.

The effectiveness of the four programmes was evaluated to assess: health outcomes; patient confidence of self-management and experience of care; and measures of healthcare utilisation (including unscheduled hospital admissions). Benefits were shown across all these measures.

3. References to the research

3.1. Research outputs

R1. Brims, F. J., **Chauhan, A. J.**, **Higgins, B.**, & **Shute, J. K.** (2009). Coagulation factors in the airways in moderate and severe asthma and the effect of inhaled steroids. *Thorax*, *64*(12), 1037-1043. https://doi.org/10.1136/thx.2009.114439

R2. Hinks, T., Brown, T., Lau, L., Rupani, H., Barber, C., Elliott, S., Ward, J. A., Ono, J., Ohta, S., Izuhara, K., Djukanović, R., Kurukulaaratchy, R. J., **Chauhan, A**., & Howarth, P. H. (2016). Multidimensional endotyping in patients with severe asthma reveals inflammatory heterogeneity in matrix metalloproteinases and chitinase 3-like protein 1. The Journal of allergy and clinical immunology, 138(1), 61-75. https://doi.org/10.1016/j.jaci.2015.11.020

R3. **Asiimwe, A., Brims, F.,** Andrews, N.**, Prytherch, D.**, **Higgins, B.**, **Kilburn, S.**, & **Chauhan, A.** (2011). Routine laboratory tests can predict in-hospital mortality in acute exacerbations of COPD. Lung, 189(3), 225-232. https://doi.org/10.1007/s00408-011-9298-z

R4. Brims, F., Asiimwe, A., Andrews, N., **Prytherch, D.**, **Higgins, B.**, **Kilburn, S.**, & **Chauhan, A.** (2011). Weekend admission and mortality from acute exacerbations of chronic obstructive pulmonary disease in winter. *Clinical Medicine*, *11*(4), 334-339. https://doi.org/10.7861/clinmedicine.11-4-334

R5. Gunatilake, S., Brims, F. J. H., **Fogg, C.**, Lawrie, I., Maskell, N., Forbes, K., Rahman, N., Morris, S., **Ogollah, R.**, Gerry, S., Peake, M., Darlison, L., & **Chauhan, A. J.** (2014). A multicentre non-blinded randomised controlled trial to assess the impact of regular early specialist symptom control treatment on quality of life in malignant mesothelioma (RESPECT-MESO): study protocol for a randomised controlled trial. *Trials*, *15*(367). https://doi.org/10.1186/1745-6215-15-367

3.2 Evidence of the quality of the research

These outputs are a representative selection of a substantial body of work in this area. They are original research studies employing robust research design, relevant research techniques and appropriate data analysis and interpretation. All are published in respected peer-reviewed academic journals: combined, they have been cited 200 times (Scopus, range 6 - 94).

3.3 Related grants

G1. **Shute, J. K**. *Coagulation factors and exacerbations of asthma*. Funded by Asthma UK, 1/01/2011 - 31/12/2011 (GBP48,513; UoP part: 36,471).

G2. Howarth, P. (PI), Davies, D. E., Laws, D., Djukanovic, R., **Chauhan, A. J.** (Co-I), Kurukulaaratchy, R. J. *Wessex severe asthma cohort*. Funded by the Medical Research Council, 01/2009 - 01/2014 (GBP666,711).

G3. **Chauhan, A. J**. (PI). *Malignant Mesothelioma - Can we Improve Quality of Life (RESPECT-Meso)*. Funded by The British Lung Foundation (ClinicalTrials.gov Identifier: NCT03068117), 04/2014 - 04/2017 (GBP174,656).

4. Details of the impact

The four integrated, community-based programmes (MISSION Asthma; the Breathlessness Programme; MISSION COPD; MISSION ABC) provided an entirely new model for the assessment and care of individuals with chronic respiratory diseases. By bringing together specialist diagnosis and care teams into a single community-based setting, patients were assessed, and a programme of tailored care initiated in a single day. This approach was dramatically different to the traditional model of a series of appointments in secondary care, thus saving many months of delay before diagnosis and treatment. Furthermore, personalised plans, reinforced with education, enabled effective self-management of patients' symptoms. Finally, the timely identification and intervention in cases of at-risk individuals significantly reduced unscheduled care from respiratory crises, reducing the, often significant, impact on individuals and on healthcare infrastructure.

Improvements in the health of patients with chronic respiratory conditions

Each programme reported significant health benefits in the patients enrolled. In the six months following the Breathlessness, MISSION Asthma and MISSION COPD programmes, exacerbations were reduced by 89%, 37% and 50%, respectively (**S1**). Unscheduled hospital admissions, often the result of respiratory crises, were eliminated in all but the MISSION COPD programme, where they were reduced by 55% (**S1**). These marked reductions were achieved by identifying, diagnosing and treating at-risk patients and through the education of patients, carers and primary care staff. Education activities were wide-ranging, including the development of self-management plans and proper inhaler use. Prior to the programme, only 39% of patients attending MISSION COPD clinics recognised the need to improve their inhaler technique and 87% were judged to have inadequate technique that would reduce the efficacy of treatment (**S2**). Personalised plans, reinforced with education, resulted in patients becoming significantly more confident in managing their condition (**S2**, **S3**). One patient reported '*being taught how to use medications correctly ... for the first time*' (**S4**). Healthcare practitioners also recognised these benefits. A member of the specialist clinical team commented: '*I think by going out and doing the education side of things you hopefully have a knock-on effect for the rest of the practice, as well and for all the patients even if you haven't seen them.*' (**S3**). Benefits extended beyond a reduction in exacerbations related to a patient's primary condition. Following the MISSION Asthma programme, there was a 47% reduction in medicine use, including antibiotics, evidencing that this novel intervention also substantially reduced comorbidities in this population (**S5**).

Improvements in quality of life

The benefits to patients' quality of life and wellbeing have been significant. Patients have reported relief and reassurance in understanding their symptoms, and greater confidence in self-managing. One patient explained: '*[I have] wheezed...all my life. But [the programme] has enabled me, in my eighties, to be totally unwheezy. Whereas before, I never thought I could walk more than 250 yards without wheezing, with the medication and… exercising, I'm now more than happy to walk for 12 minutes.'* (**S6**). This improvement in quality of life was long-lasting, seen in 75% patients six months after the MISSION Asthma clinics (**S5**). Improvements to quality of life were recognised by healthcare practitioners, with one Respiratory Nurse Lead commenting: '*...within the month, his [the patient's] whole life had completely changed. It's a transformation from someone who was*

housebound. The impact is clear. He is now mentally and physically well. I had these types of stories throughout the day.' (**S3**).

Identifying undiagnosed disease and at-risk patients

By providing screening questionnaires, physiological assessment and medical review, each programme identified patients with undiagnosed or uncontrolled respiratory disease. For example, of the COPD patients recruited in MISSION COPD, 24% were subsequently diagnosed with asthma, asthma-COPD overlap and even heart failure (**S7**). Accurate diagnosis is key to management of symptoms and in preventing exacerbations. This is particularly important given the 3,700,000 people in the UK with undiagnosed COPD. Identifying those at high risk of having undiagnosed COPD enables earlier diagnosis and evidence-based chronic disease management. If this results in a 25% reduction in mortality in people who would otherwise have been admitted with undiagnosed COPD, it would save approximately 400 lives per year (**S4**). All four programmes referred patients to hospital because of the severity of their condition, in some cases, patients had very serious diseases that may not have been detected otherwise (**S3**).

Cost savings associated with reduced health services utilisation and benefits to national productivity

Breathlessness, MISSION Asthma and MISSION COPD programmes delivered significant reductions in health service utilisation, including reductions in unscheduled GP (84, 39, 48%), out-of-hours GP (100, 80, 98%) visits and visits to Emergency Departments (100, 67, 97%) (**S1**). This reduction in health services utilisation, and requirement for medicines, results in cost savings of between GBP90 and GBP490 per patient (**S5**, **S7**). This equates to projected savings in Wessex of GBP12,000,000 for asthma, and GBP1,200,000 - GBP5,900,000 for COPD. If the programmes were to be adopted nationally, projected savings would be GBP450,000,000 for asthma and GBP100,000,000 - GBP500,000,000 for COPD. Indirect cost savings are also significant. Most people with chronic respiratory diseases report breathlessness as being the major disabling symptom that interferes with everyday activities. A survey by the British Lung Foundation found that around 40% of people with lung disease are below retirement age and a quarter of these are unable to work, costing business an estimated 24 million working days in sick leave each year (**S3**).

Changes to practice: management of chronic respiratory conditions in primary care

In addition to the education provided to patients, the programmes provided education to healthcare practitioners working in primary care through the provision of diagnosis and therapeutic guidelines, a guided consultation template and videos on respiratory consultation, breathing control and mucus clearance. Across the four programmes, healthcare practitioners at 17 GP surgeries in Hampshire received these resources and training. Testimonials reflect that this upskilling led to an increased confidence and satisfaction: *'In the GP surgery – there's been lots of learning. You're just more aware of approaches to take to breathlessness symptoms. We've been taught better procedures, like inhaler techniques. That's something quite big really because if patients aren't taking their inhaler properly, they aren't getting their medication.'* (**S3**)

Developments since MISSION: community-based education for respiratory conditions and other chronic conditions

Recognising the value of education in improving symptom management and reducing healthcare utilisation, an ongoing clinical trial, ESMENA (Education, Self-Management and Empowerment in exacerbatioN prone Asthma, April 2018 to December 2021; ISRCTN17338269) is evaluating an education programme aimed to reduce asthma exacerbations. As with MISSION programmes, ENSEMA utilises a multi-disciplinary team to deliver community-based education in order to improve asthma control, improve patients' quality of life and reduce the incidence of respiratory crises and associated hospitalisations.

The team has also developed the Wessex Asthma Toolbox that contains clinical equipment, demonstration models, information and guidance to aid healthcare professionals to educate people with asthma. Distributed at educational events, the toolbox is in use in 107 of 120 GP surgeries in the Wessex region, benefitting approximately 120,000 asthmatics. In a survey to capture feedback following initial uptake, all 61 healthcare providers that responded said that they use the Toolbox for asthma reviews as a visual aid, educating colleagues and to assist in prescribing the correct inhalers (Primary Care Respiratory Update 2020). MISSION ABC offers a toolkit via their website (missionabc.uk) that allows healthcare practitioners to implement

MISSION-style assessment and care via specialist multidisciplinary clinics. The toolkit is recommended by NICE (**S4**). Since 2017, at least ten Clinical Commissioning Groups in England have implemented the MISSION approach for the management of chronic respiratory conditions, benefitting around 860,000 sufferers of asthma and COPD.

The MISSION model has been translated for the assessment and care of patients with other long-term conditions, including dementia and diabetes. MISSION Diabetes is being piloted in 2 GP practices. Its carousel model incorporates a single day of appointments with a GP, podiatrist, a dietician, diabetologist, diabetes specialist nurse, ophthalmologist and psychologist. The multidisciplinary team provides each patient with a personalised plan to manage his or her condition. MISSION Dementia, being piloted in a single GP surgery, integrates the GP, carer(s), secondary care and specialist support services to support patients and families following dementia diagnosis. 92% of participants agreed that they had a positive experience in the ease of access to the service, with one carer commenting: '*I feel the practice [has] been our main source of support since my mother's diagnosis. The team has provided a great deal of knowledge, understanding and guidance that no other mental health service has offered*.' (**S8**).

Recognition for MISSION programmes

The MISSION programmes have been shortlisted for numerous national healthcare awards. MISSION Asthma won HSJ awards for Value in Diagnostics (2015) and for Innovation in Primary Care (2016). MISSION COPD won a Patient Safety Award in 2016. The judging panel said: *'If patients with severe COPD can be recognised before they arrive in hospital in a crisis, there is a lot that can be done to improve their lives, their health and the cost to the NHS of looking after these individuals. Portsmouth's MISSION COPD does just that'*. The Wessex Asthma Toolbox was nominated in two categories, 'Respiratory Nursing' and 'Managing Long Term Conditions', at the Nursing Times Awards 2019.

In summary, a one-stop assessment-and-care clinic delivers significantly improved symptom management and associated quality of life. In providing patients the means to effectively self-manage their conditions, the incidence of unscheduled admissions from crises is greatly reduced, massively reducing the impact on patients and healthcare infrastructure. This approach is now in use nationally and has been successfully applied in other long-term health conditions.

5. Sources to corroborate the impact

S1. Independent evaluation of the North East Hampshire and Farnham Vanguard MISSION Test Clinic. Wessex Academic Health Science Network. (01/2017)

S2. MISSION COPD: Modern Innovative SolutionS Improving Outcomes iN COPD Portsmouth Hospitals NHS Trust. The Health Foundation. (08/2016) https://www.health.org.uk/sites/default/files/Portsmouth%20MISSION%20COPD%20final%20report%20for%20website.pdf

S3. Evaluation of the NHS Breathlessness Pilots: Report of the Evaluation Findings. Report for NHS England. (31/03/2016)

S4. NICE shared learning database: Modern Innovative SolutionS Improving Outcomes iN Asthma Breathlessness and COPD (MISSION ABC). (02/2018) https://bit.ly/2ROzHOL

S5. MISSION Asthma - Health Economics report on the first pilot. Wessex Academic Health Science Network. (23/11/2015)

S6. Vimeo video: Mission ABC: Improving lives for people with chronic lung disease. Includes patient testimonial, 2m32s - 3m31s. Wessex AHSN Limited. (2016) https://vimeo.com/187813049

S7. Lanning, E., Longstaff, J., Jones, T., et al. (2019). Modern Innovative Solutions in Improving Outcomes in Chronic Obstructive Pulmonary Disease (MISSION COPD): Mixed Methods Evaluation of a Novel Integrated Care Clinic. *Interactive Journal of Medical Research*, *8*(4), [e9637]. https://doi.org/10.2196/ijmr.9637

S8. Badcock, K., Dementia Advisor, MISSION Dementia Project presentation. (02/2020) https://gpnen.org.uk/wp-content/uploads/2020/02/Dementia-Care-Kim-Badcock-QN.pdf