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**Developing awareness of sustainability in nursing and midwifery using a scenario-based approach: Evidence from a pre and post educational intervention study**

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experience of clinical practice to the discussions. This engagement challenges us and helps us to find new ways to integrate sustainability into the curriculum.

## **Abstract**

### Background

The delivery of healthcare has an impact on the environment and contributes to climate change. As a consequence, the way in which nurses and midwives use and dispose of natural resources in clinical practice, and the subsequent impact on the environment, should be integral component of nursing and midwifery education. Opportunities need to be found to embed such issues into nursing curricula; thus bringing sustainability issues 'closer to home' and making them more relevant for clinical practice.

### Objectives

The study was designed to measure the impact of a sustainability-focussed, scenario-based learning educational intervention on the attitudes and knowledge of student nurses and midwives.

### Design

Pre-test/Post-test intervention study using scenario-based learning as the educational intervention. The Sustainability Attitudes in Nursing Survey (SANS\_2) was used as the outcome measure.

### Settings

Clinical skills session in a UK University School of Nursing and Midwifery.

### Participants

676 second year undergraduate nursing and midwifery students.

### Methods

The 7-point scale SANS survey was completed before and after the teaching session; standard non-parametric analysis compared pre and post intervention scores.

## Results

Changes were observed in attitude towards climate change and sustainability and to the inclusion of these topics within the nursing curricula ( $p=0.000$ ). Participants demonstrated greater knowledge of natural resource use and the cost of waste disposal following the session ( $p=0.000$ ). Participants also reported that sessions were realistic, and levels of agreement with statements supporting the value of the session and the interactive nature of delivery were higher following the session.

## Conclusions

Using a scenario-based learning approach with nursing and midwifery students can change attitudes and knowledge toward sustainability and climate change. Embedding this approach in the context of clinical skills provides a novel and engaging approach that is both educationally sound and clinically relevant.

Keywords: Nurse Education, climate change, resources, sustainability, scenario-based learning, clinical skills

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## Background

Health professionals are becoming increasingly concerned about the health impacts of climate change and the impending challenges they will face in delivering healthcare (Bell 2010; Nichols *et al.*, 2009; Goodman and Richardson 2010; Richardson and Wade 2010; Goodman and East 2014). The potential health impacts of a changing climate are now well documented and will have most impact on the developing world and low-lying nations (Costello *et al.*, 2013). However, recent events such as heatwaves and flooding, demonstrate that developed countries will also be affected (see for example UK Flood Guidance 2017). Haines *et al.*, (2006) point out that the 'dramatic advances in health' seen in recent decades may be reversed as populations, especially poorer groups, suffer the repeated stresses of flooding. This can lead to exacerbation of conditions such as asthma, and an increase in waterborne infectious diseases. Furthermore, loss of income and insurance cover as a consequence of flooding can also have detrimental impacts on health status.

In the UK, attempts are being made to raise awareness and consider how best to mitigate against the damaging effect of our over use of fossil fuels which are seen as a key determinant in the damage to the environment (Department of Energy and Climate Change 2011). The UK national awareness raising programme 'Keep it in the ground' (The Guardian 2016) in response to Greenpeace and other non-government organisations' lead, has been informative and helpful in getting the general public to understand the major issues. However moving businesses away from an over reliance on fossil fuels and supporting the development of alternative energy sources has had a mixed response (Ihlen 2009). Webb (2012) draws attention to the complexities inherent in challenging a consumerist society to consider the amount of resource they use. In reality, however, this may be forced on consumers, given that the Intergovernmental Panel on Climate Change (IPCC 2014) report warns that extreme weather events will push up prices of some goods and make them unaffordable for some consumers. Furthermore, it is not only 'consumer goods' that are of concern, once basic food stuffs are threatened then there is a potential for poor diets to lead to deteriorating health (Food and Agriculture Organization of the United Nations 2008).

The annual procurement budget of the NHS is £100bn and efforts to reduce this will result in positive effects on the carbon burden (Department of health 2013). The provenance of the raw materials used in healthcare, how they are manufactured, packed and transported creates a high carbon load at every stage (Grose and Richardson 2013a). How we use the resources requires awareness of their cost and knowledge of the evidence surrounding infection prevention and when items can safely be re-used (Nichols *et al.*, 2016). Of significant concern is how the overuse of physical resources negatively affects carbon reduction targets set out by the UK NHS. In 2015 the NHS carbon footprint in England was 22.8 million tonnes of carbon dioxide equivalents (MtCO<sub>2</sub>e) (NHS Sustainable Development Unit 2016). Inevitably as more materials are used, more waste is generated by healthcare activity. However, the NHS carbon strategy is moving in the right direction. For example between 2007 and 2015 the carbon footprint of the NHS in England reduced by 11% largely due to the efforts made by hospital Estates Departments to reduce energy use and move towards more sustainable methods of creating energy (NHS Sustainable Development Unit 2016). Inevitably as the carbon footprint of the NHS has reduced, the burden of the waste produced by delivering healthcare remains a significant challenge (Nichols *et al.*, 2016).

Researchers are building an evidence- base on which to develop strategies to meet the challenges associated with a changing climate and potential threats to the scarce natural resources required in the delivery of healthcare (Richardson *et al.*, 2008, 2009; Nichols *et al.*, 2011; Grose and Richardson 2012; Anaker and Elf 2014). Bell *et al.*, (2012) have considered how it might be possible to create an 'adaptive' health service workforce who are cognisant of the evidence, and have clinical care strategies that enable resilience in the face of extreme weather events or decreased resources availability. Education will be essential to building a resilient and adaptive nursing and midwifery workforce (Goodman and East 2014). This will require awareness of the health impacts of climate change, as well as and understanding of the environmental impacts of healthcare delivery.

There are opportunities to embed issues regarding climate change and health into nursing curricula in the context of global and public health by making connections with the changing climate and natural resources (Goodman and Richardson 2010;

Richardson and Wade 2010; Richardson *et al.*, 2014, 2015, 2016). This brings the issues 'closer to home' by making them more relevant for clinical practice (Grose and Richardson 2015).

Using existing evidence (Goodman and Richardson 2010; Grose and Richardson 2013a, 2013b; Richardson *et al.*, 2014; 2015), this paper reports on the evaluation of an interactive and transferrable educational approach to embedding sustainability in healthcare teaching.

The research question posed in this research is: can an educational intervention designed to raise awareness about sustainability impact on attitudes and knowledge of student nurses and midwives?

## **Methods**

### Intervention

Within nursing, midwifery and healthcare education more generally, the aim is to focus on students' ability to assimilate knowledge and build practical skills that they can then transfer to clinical practice. Rehearsal and learning within simulated clinical skills environment is one strategy for achieving this as it utilises principles of active learning (Cioffi 2001). The intervention used here is a health and sustainability scenario session that has been delivered to over 600 student nurses, midwives and other healthcare professionals such as dentists and general practitioners. The session is evidence-based and designed to represent a hypothetical but clinically relevant scenario that engages students in discussion about the impact of healthcare on the environment, and issues regarding sustainability and climate change (Richardson *et al.*, 2014). The scenario is based on research undertaken in the UK National Health Service (NHS) that examined the potential for interruptions in the supply chain of items important for clinical care that are manufactured from natural resources (Grose and Richardson 2012). Using principles from education for sustainable development (ESD) it was designed to be interactive and clinically relevant, using principles from social learning theory (Sterling 2007).

Participants were facilitated in small groups during clinical skills sessions. The session ran for approximately 50 minutes and considered a scenario where the

global price of plastic is increasing. Using the Internet, students are encouraged to discuss where plastic comes from and factors that might lead to a price rise. Items used in everyday clinical practice that are made from plastic were handed to students and they were asked to consider the impact on patient care if the natural resource (oil) were no longer available to make items such as intravenous giving sets and infusion bags, medicine pots, syringes and blister packs. An 'impact line' (made from a tape measure) was provided and students were invited to place the item on the line, ranging from 'no impact on patient care' to 'high impact on patient care'. The purpose of this was to encourage students to discuss how these items are used (and over-used) and to think about what alternative items or materials might be substituted. The students are then given an example of how the item could have been used in clinical practice, and whether it was potentially contaminated. Based on the example, they were asked to allocate the item to 'clinical waste', 'domestic waste', or 'other' (for example re-use or recycle), providing an explanation for their choice. Finally they were asked to estimate the cost of disposing of a 5KG bag of domestic waste and a 5KG bag of clinical waste; costs (based on the average calculation for England) are revealed at the end of the session. For details of how the session works see <http://youtu.be/zIFT2Dbg08o>

### Participants

Participants were nursing (adult and child health programmes) and midwifery students in their second year of studying at a University in South West England. Data was collected over a two year period which included the 2103 and 2014 cohorts. Full ethical approval was provided by the Faculty Research and Ethics Committee.

### Measures

The 'Sustainability Attitudes in Nursing Survey' (SANS\_2) questionnaire used in this study was developed and piloted at Plymouth University (UK) with second year student nurses (Richardson *et al.*, 2014) Questions were designed to elicit agreement or disagreement with statements regarding climate change and sustainability, and the inclusion of these topics in the nursing and midwifery curriculum. Development of the questionnaire was based on discussions with experts from nursing education, formulation of the items was based on face validity with special emphasis to ensure that only one unit of meaning was included. Initially



a 7-item SANS questionnaire was translated and piloted with 363 nursing students in three universities (one each in Germany, Spain and UK). In order to determine factor structure, a factor analysis (Principal Component Analysis) using the Scree Test was used; Cronbach's alpha was used for internal consistency. Pearson product–moment correlations were computed to assess linear dependence of items. Psychometric analyses were performed for the whole sample and for the individual countries. Item intercorrelations were all positive and highly significant and ranged from .28 to .80. Reliability Analysis revealed a Cronbach's alpha of .86. All psychometric analyses were repeated for data from each country revealing results that are comparable to the results found in the total sample. Further analyses revealed that dropping specific items would not result in reduced internal consistency. Based on the pilot the SANS questionnaire was revised so that SANS\_2 focuses on 5 Likert scale items. The SANS\_2 attitude items can be found in Box 1. The SANS\_2 version of the questionnaire was translated into French, Spanish and German in order to evaluate the attitudes of student nurses in a number of Schools of Nursing in Europe (Richardson et al 2016).

More recently the SANS\_2 questionnaire has been translated for use with student nurses in Sweden and five Arab speaking countries (personal communication), and has been adapted for use with paramedic students (Richardson *et al.*, 2016a).

Box 1. Attitude items used in the 7-point Likert scale

Climate change is an important issue for nursing / midwifery

Issues about climate change should be included in the nursing / midwifery curriculum

Sustainability is an important issue for nursing / midwifery

Sustainability should be included in the nursing / midwifery curriculum

I apply sustainability principles in my nursing / midwifery practice

I apply sustainability principles at home

The segregation of healthcare waste is important

A 7-point Likert scale with the end-points 1 = “strongly disagree” and 7 = “strongly agree” was used. Likert scales of this format are widely used in social and health research. Many studies show that this form of assessment can yield reliable and valid information on target constructs (Bertram accessed 11/11/2014).

Students were also asked to state the average cost of disposal, in the UK National Health Service (NHS), of a 5kg bag of domestic waste and a 5kg bag of clinical waste. On the questionnaire they were provided with 6 response options for each question and asked to circle their response; these were scored as correct or incorrect. This data was treated as categorical using frequencies of correct and incorrect answers in the data analysis. A further question ‘what natural resource is plastic made from?’ was included and was scored as correct or incorrect. The aim of these three additional items was to capture specific knowledge gained from the focus of the sustainability and health scenario session. All participants completed a questionnaire before the session started (pre-intervention) and immediately following the session (post-intervention). Additionally participants from the 2014 cohort were also invited to complete a post session ‘feedback questionnaire’ following the intervention that invited feedback about the session. This questionnaire used a 7-point Likert scale on which participants were asked to rate their agreement or disagreement with a number of statements about the session, where 1 indicated ‘strongly disagree’ and 7 indicated ‘strongly agree’ (Box 2).

Box 2. Feedback about the session on a 7-point Likert scale

- The scenario was realistic
- The resources were useful
- The scenario was interesting
- The session was engaging
- The session helped to make links between climate change and health
- The session helped to make links between resources and health
- I enjoyed the discussion
- I would prefer the session as a lecture

Data were entered into SPSS version 22 using a participant number in order to ensure anonymity of individual responses. Statistical analyses for the SANS\_2 were based on tests for normal distribution. Examination of histograms and Kolmogorov-Smirnov tests of normality suggests that the data deviated from normality,  $p = 0.00$  in all cases indicating the use of non-parametric tests. Therefore, Wilcoxon Matched-Pairs Signed-Rank tests examined the differences between the scores of the pre and post intervention survey, a higher mean rank indicated that attitudes were more towards 'strongly agree'. The knowledge questions required responses based on categorical data therefore the McNemar tests were used in order to examine correct and incorrect responses. Descriptive analysis was used for the 'session feedback questionnaire'.

## **Results**

Six hundred and seventy six students participated in the sustainability scenario sessions and completed a SANS\_2 questionnaire before and following the session, 384 of these also completed the additional questions relating to feedback about the sessions.

Wilcoxon Matched-Pairs Signed-Rank tests revealed significant differences ( $p = 0.000$ ) were found between the pre and post intervention questionnaires for all the SANS\_2 statements. Means indicate higher scores (greater agreement) for the statements following the educational intervention (see Table 1).

The McNemar tests performed on the knowledge questions: what natural resource is plastic made from (Table 2); cost of clinical waste (Table 3); cost of domestic waste (Table 4), evidenced participants were more likely to answer these questions correctly following the educational intervention ( $p = 0.000$ ).

Table 1. Pre and post-intervention means

Item	Pre-intervention mean (SD)	Post-intervention mean (SD)	<i>P</i> value
Climate change is an important issue for nursing & midwifery	4.74(1.4)	5.95(1.2)	0.000
Issues about climate change should be included in the nursing & midwifery curriculum	4.19(1.4)	5.73(1.3)	0.000
Sustainability is an important issue for nursing & midwifery	5.29(1.3)	6.29(1.0)	0.000
Sustainability should be included in the nursing & midwifery curriculum	4.92(1.3)	6.06(1.1)	0.000
I apply sustainability principles in my nursing & midwifery practice	4.28(1.2)	5.09(1.3)	0.000
I apply sustainability principles at home	4.97(1.3)	5.40(1.3)	0.000
The segregation of healthcare waste is important	5.95(1.2)	6.36(1.0)	0.000

Table 2. What natural resource is plastic made from?

		Where does plastic come from (post scenario)		Total
		Yes	No	
Where does plastic come from (pre-scenario)	Yes	153	3	156
	No	434	77	511
Total		587	80	667

Table 3. Cost of clinical waste

		Cost of Clinical Waste (post-scenario)		Total
		Yes	No	
Cost of Clinical Waste (pre-scenario)	Yes	78	8	86
	No	508	70	578
Total		586	78	664

Table 4. Cost of domestic waste

		Cost of Domestic Waste (post-scenario)		Total
		Yes	No	
Cost of Domestic Waste (pre-scenario)	Yes	108	10	118
	No	491	54	545
Total		599	64	663

Three hundred and eighty four participants completed the questions asking for feedback on the session. For the statement 'The scenario was realistic' 77% of participants scored 6 or 7 (7 being the highest possible score on the scale), indicating strong agreement with the statement. For all other statements scores of 6 or 7 were provided by at least 81% of participants (see Table 5). The exception to this was the statement 'I would prefer the session as a lecture'. For this statement 73% of participants scored in the range of 1 – 3 (reflecting strong disagree) and only 7% scored 6 or 7.

Table 5 Scores reflecting feedback of the session on a 7-point scale where 1 = 'strongly disagree' and 7 = 'strongly agree' (note that some statements had missing data hence percentages vary)

Statement & Scores	1	2	3	4	5	6	7
The scenario was realistic	2(0.5%)	0	5(1.3%)	19(5%)	58(15.4%)	138(36.6%)	155(41.1%)
The resources were useful	0	1(0.1%)	2(0.5%)	13(3.4%)	51(13.5%)	127(33.7%)	183(48.5%)
The scenario was interesting	0	2(0.5%)	3(0.8%)	10(2.7%)	44(11.7%)	121(32.1%)	197(52.3%)
The session was engaging	0	1(0.3%)	3(0.8%)	6(1.6%)	48(12.8%)	113(30.1%)	205(54.5%)
The session helped to make links between climate change and health	1(0.3%)	2(0.3%)	10(2.7%)	12(3.2%)	43(11.4%)	115(30.5%)	194(51.5%)
The session helped to make links between resources and health	0	2(0.5%)	4(1.1%)	7(1.9%)	42(11.1%)	116(30.8%)	206(54.6%)
I enjoyed the discussion	0	1(0.3%)	3(0.8%)	16(4.2%)	45(11.9%)	117(31.0%)	194(51.5%)
I would prefer the session as a lecture	142(37.7%)	80(21.2%)	53(14.1%)	52(13.8%)	26(6.9%)	18(4.8%)	6(1.6%)

## Discussion

The results of our evaluation demonstrate that this approach to teaching the challenging issues of climate change and resource scarcity can change both attitudes and knowledge. Following the educational intervention, participants were more likely to agree with statements suggesting that climate change and sustainability are important for nursing and midwifery and that these subjects should be included in curricula. Furthermore, participants' knowledge of resources and the cost of disposing of healthcare waste improved following the sessions. One interesting observation is that the scores regarding sustainability at home increased following the educational intervention. This may be due to social desirability (student wanting to be seen as being sustainable), or this could be the consequence of raising awareness about their sustainability behaviour at home through the class discussion.

Those participants (2104 cohort) who completed the additional questions evaluating the sessions reported high levels of agreement with statements related to the relevance of the sessions. This suggests that they found it engaging, interesting, and that it helped them to make links to climate change and health, as well as links with resource use and scarcity. Moreover, the results suggested that the majority of students would not prefer to have the session content delivered as a lecture.

The subject of education for sustainable development (ESD) has a tradition grounded in social learning theory (Glasser 2007), where active social learning is a function of skills, values, and relationships. Furthermore, co-learning supports change, as it requires engagement and 'learning by doing' (Dewey 1997). Appropriate pedagogical approaches are required if sustainability is to be embedded in nursing and healthcare curricula. Sterling (2007, p78) for example, talks of learning about sustainability as 'learning – reflexive, experiential, experimental, participative, iterative and action-oriented'. The scenario-based educational intervention reported in this paper was based on research that focused on waste management and resource scarcity (Grose and Richardson 2013a,b), and has been developed as an interactive approach in order to fully engage students in discussion about the clinical relevance of these issues (Grose and Richardson 2015). Students

learn in different ways, however engagement in simulated scenarios that are relevant to clinical practice are likely to be an effective method of learning (Kneebone 2005).

There is an imperative to ensure that nurses and healthcare professionals are aware of the impact of healthcare delivery on the environment, and conversely the impact of climate change and resource scarcity on health and healthcare. For example The Royal College of Nursing initiative to engage nurses in the process of procurement highlights the impact of the profession on healthcare resource use (RCN 2016).

This session has been delivered to over 600 nursing and midwifery students at Plymouth University and is now fully embedded in the nursing and midwifery curriculum. Sessions are also provided for other healthcare practitioners and management students. The approach is evidence-based, has been tested and refined over a number of years and has wider transferability. The sessions are easy to run and, as facilitators, we find them engaging and interactive. Furthermore, they provide significant opportunities to discuss variations in practice and links with other clinical issues such as infection prevention. What is required now is a mechanism for revisiting these issues throughout the whole of the curricula in such a way that reinforces sustainable behaviour. Further research is required to investigate the extent to which these session impact on clinical practice in the workplace.

It is undeniable that human activity has had a significant impact on the planet and that the delivery of healthcare contributes to this (IPCC 2014). As responsible citizens, and healthcare professionals, we have a duty to live and work in a way that treads lightly on the Earth while conserving resources for future generations. As healthcare educators we have a duty to ensure that the professionals we teach are competent to practice in a changing climate.

### **Relevance to clinical practice**

A wide range of items used in everyday clinical practice are made from natural resources which are under threat due to climate change and scarcity. Furthermore many clinical resources are segregated inappropriately leading to excess clinical waste that is incinerated at financial and environmental costs. Nurse educators need to ensure that student nurses have an awareness of this in order that they can



practice within the context of safety and sustainability.

## References

Anaker, A., Elf, A. (2014) Sustainability in Nursing a concept analysis. Scandinavian Journal of Caring Studies. 381-389

Bell, E. (2010) Climate change: What competencies and which medical education approaches? BMC: Medical Education. 10:31

Bell, E., Horton, G., Blashki, G., Bastian, M., 2012. Climate change: could it help develop 'adaptive expertise'? Adv. Health Sci. Educ. 17, 211–224.

Betram, D. <http://poincare.matf.bg.ac.rs/~kristina/topic-dane-likert.pdf> (Accessed 29/04/2016)

Coiffi, J. (2001) A study of the use of past experiences in clinical decision making in emergency situations. International Journal of Nursing Studies 38, 591-599

Costello, A., Montgomery, H., Watts, N. (2013) Climate change: The challenge for health professionals. British Medical Journal. 347:f6060 doi: 10.1136/bmj.f6060.

Department of Energy and Climate Change National Policy Statement for Fossil Fuel Electricity Generating Infrastructure (EN-2) (2011)  
[https://www.gov.uk/government/uploads/system/uploads/attachment\\_data/file/47855/1939-nps-for-fossil-fuel-en2.pdf](https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/47855/1939-nps-for-fossil-fuel-en2.pdf) (Accessed 28/02/2017)

Department of Health (2013) Policy and guidance to help the NHS achieve excellence, value for money, and improvement in procurement. [www.gov.uk/government/collections/nhs-procurement](http://www.gov.uk/government/collections/nhs-procurement) (Downloaded 15/09/2016)

Dewey J (1997) Experience and Education. New York, Simon and Schuster

Food and Agriculture Organization of the United Nations (2008). Climate Change and Food Security: A Framework Document <http://www.fao.org/forestry/15538-079b31d45081fe9c3dbc6ff34de4807e4.pdf> page 41 (accessed 01/03/2017)

Glasser, H. (2007) Minding the gap (p51). In: Wals A.E.J (ed) Social Learning: towards a sustainable world. The Netherlands, Wageningen

Goodman, B., Richardson, J. (2010) Climate Change, Sustainability and Health in UK Higher Education: The Challenges for Nursing pp109 - 131. In: Jones, P., Selby, D., Sterling S. Sustainability Education: Perspectives and Practice Across Higher Education. London, Earthscan

Goodman, B., East, L. (2014) The 'Sustainability Lens' A framework for nurse education that is 'fit for the future'. Nurse Education Today. 34:100-103

Goodman, B., Richardson, J. (2010) Climate Change, Sustainability and Health in UK Higher Education: The Challenges for Nursing (pp109 – 131). In: Jones, P., Selby, D., Sterling, S. Sustainability Education: Perspectives and Practice Across Higher Education. London, Earthscan.

Grose, J., Richardson, J. (2012) Raw Materials Risk in Healthcare Supply Chains. WRAP <http://www.wrap.org.uk/content/report-raw-materials-risk-healthcare-supply-chains>

Grose, J., Bennallick, M., Nichols, A., Pahl, S., Richardson, J. (2012). Facilitating Sustainable Waste Management Behaviours Within the Health Sector: A Case Study of the National Health Service (NHS) in Southwest England, UK. Sustainability 4: 630 – 642; doi: 10.3390/su4040630 Open Access

Grose, J., Richardson, J. (2013a) "Managing a sustainable, low carbon supply chain in the English National Health Service: The views of senior managers", Journal of Health Services Research & Policy, 18(2): 83-89

Grose, J., Richardson, J. (2013b) Strategies to identify future shortages due to interruptions in the healthcare procurement supply chain: a method from the English National Health Service. Journal of Health Service Research Policy and Practice. 19/1(19-26), 1355-8196 <http://hsr.sagepub.com/content/19/1/19>

Grose, J., & Richardson, J. (2015) Can a sustainability and health scenario provide a realistic challenge to student nurses and lead to a commitment to making changes in practice? *Nursing and Health Sciences* doi: 10.1111/nhs.12241

Haines, A., Kovatts, R.S., Campbell-Lendrum, D., Corvalan C (2006) Climate change and human health: Impacts, vulnerability and public health. *Public Health*.120:586-596

Ihlen, O. (2009) Business and Climate Change: The Climate Response of the World's 30 Largest Corporations. *Environmental Communication*. 2(2)244-262

IPCC Report (2014) Climate Change 2014: Impacts, Adaptation, and Vulnerability [ipcc-wg2.gov/AR5/images/uploads/WG2AR5\\_SPM\\_FINAL.pdf](http://ipcc-wg2.gov/AR5/images/uploads/WG2AR5_SPM_FINAL.pdf)  
(downloaded 15/09/2016)

Kneebone, R. (2005) Evaluating clinical simulation for learning procedural skills: a theory based approach. *Academic Medicine* 80(6), 549-553

NHS Sustainable Development Unit <http://www.sduhealth.org.uk/policy-strategy/reporting/nhs-carbon-footprint.aspx> (accessed 15/09/2016)

Nichols, A., Maynard, V., Goodman, B., Richardson, J. (2009) Health, Climate Change and Sustainability: A systematic Review and Thematic Analysis of the Literature. *Environmental Health Insights* [3]:63-88 [http://www.la-press.com/article.php?article\\_id=1603](http://www.la-press.com/article.php?article_id=1603)

Nichols, A., & Richardson, J. (2011) Climate change, Health and Sustainability: A brief survey of Primary Care Trusts in the South West of England. *Perspectives in Public Health* 131(2):82-84 <http://rsh.sagepub.com/content/131/2/82>

Nichols, A., Mukono R., Grose J (2016) Achieving cost and carbon savings in neonatal practice: A review of the literature on sustainable waste management. *Journal of Neonatal Nursing*. 22 (2):81-87

Richardson, J., Kagawa, F., Nichols, A. (2008) Health, Climate Change and Energy Vulnerability: A Retrospective Assessment of Strategic Health Authority Policy and

Practice in England. Environmental Health Insights 2 97-103 [http://www.la-press.com/article.php?article\\_id=1157](http://www.la-press.com/article.php?article_id=1157)

Richardson, J., Kagawa, F., Nichols, A. (2009) Health, Energy Vulnerability and Climate Change: A Retrospective Thematic Analysis of Primary Care Trust Policies and Practices. Public Health 123:765-770

Richardson, J., Wade, M. (2010) Public Health Threats in a Changing Climate (pp197-214). In: Kagawa, F., Selby, D (eds) Education and Climate Change: Living and Learning in Interesting Times. Oxford, Routledge.

Richardson, J., Grose, J., Doman, M., Kelsey, J. (2014) The use of evidence-informed sustainability scenarios in the nursing curriculum: development and evaluation of teaching methods. Nurse Education Today. 34:490-93

Richardson, J., Grose, J., O'Connor, A., Bradbury, M., Kelsey, J., Doman, M. (2015) Nursing students' attitudes towards sustainability and health care. Nursing Standard (29)42, 36-41

Richardson, J., Grose J., Allum, P. (2016) Can a health and sustainability scenario session change undergraduate paramedic students' attitudes towards sustainability and climate change? Journal of Paramedic Practice 8(3):130-136

Royal College of Nursing <https://www2.rcn.org.uk/newsevents/campaigns/small-changes-big-differences/how-to-guides/how-to-build-a-case-for-a-clinical-procurement-nurse-role-in-your-organisation> (accessed 02/11/2016)

Sterling, S. (2007) Riding the storm p78. In: Wals A.E.J (ed) Social Learning: towards a sustainable world. The Netherlands, Wageningen

The Guardian <https://www.theguardian.com/environment/series/keep-it-in-the-ground> (accessed 02/11/2016)

UK Flood Guidance <https://www.gov.uk/government/collections/flooding-health-guidance-and-advice> Accessed 01/03/2017

Webb, J. (2012) Climate change and Society: The chimera of behaviour change technologies. *Sociology*. 46 (1):109-125