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Reproductive health education in the schools of the four UK nations: is it falling through the gap?

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ABSTRACT

Reproductive health education is crucial to ensure young people understand their reproductive system and can make informed decisions about their sexual lives and fertility, including whether they want to have children or not. This study involved an investigation of the intended UK school curricula for 14–18 year-olds as they relate to reproductive health. Analysis revealed substantial differences. Most, but not all, specifications include sexually transmitted infections, hormonal aspects of reproduction, contraception, the menstrual cycle and assisted reproductive technology (ART). Important topics, such as endometriosis, fertility, preconception health, pregnancy, miscarriage, menopause and infertility (except in the context of ART) are missing from examination specifications and/or the RSE/RSHP curricula. We conclude that many young people in the UK are at risk of leaving school with inadequate understanding of concepts that have important implications for their reproductive health. There are differences between nations, with Scotland having the most comprehensive coverage of topics in its curriculum. High-quality reproductive health education should be an entitlement for all young people. It should give young people accurate and up-to-date information and enable them to discuss issues and develop their own thinking. Ideally, sex and reproductive health education would be taught comprehensively across the RSE/RSHP and science curricula.

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Introduction

It is widely agreed that school sex education is crucial to allow young people to make informed choices about their sexual and reproductive health and lifestyle (Allen & Rasmussen, 2017; Sundaram & Sauntson, 2016). However, the emphasis in school sex education has often been only on such biological topics as conception, contraception and sexually transmitted infections (STIs) (Reiss, 2018). For this reason, there has been a move to rename sex education 'sex and relationships education' (SRE) or 'relationships and sex education' (RSE) and put greater emphasis on the relationship aspects of the topic. However, there have been serious shortcomings in reproductive health education and the biology has all too often conveyed an implicit message that it is easy to become a parent (Littleton, 2012).

In this paper, we use the term 'reproductive health education' (e.g. Walker et al., 2021) to indicate a

broader perspective than traditional sex education, one that includes fertility education but is not restricted to it. For reproductive health, young people need to understand such topics as fertility, fertility decline with age, preconception health, pregnancy, miscarriage, infertility, endometriosis, polycystic ovary syndrome (PCOS) and menopause (Harper et al., 2017; Maslowski et al., 2022) and be enabled to discuss questions about their intended sexual lives. Encouragingly, the recent introduction of mandatory SRE in England and the occurrence of relationships, sexual health and parenthood education (RSHP) in Scotland mean that more school students in the UK are now being taught some of these topics. Our focus is on reproductive health education, but this is not a term that is used in school curricula and the topics included with reproductive health are found both in sex education and in biology.

There is a global trend towards delaying childbearing which has consequences for fertility rates, health

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and life satisfaction. There are many reasons why women do not have children (Mills et al., 2011). For some, this is an active choice; however, for others it is not (Chauhan et al., 2021; Delbaere et al., 2021; Mills et al., 2011). For too many, not having children was potentially preventable (Hammarberg et al., 2013). One of the reasons for not having children when these are desired is likely to be poor fertility education at school. Better such education might help address unrealistic media portrayals of fertility and the relatively low success of assisted reproductive technology (ART) (Littleton, 2012; Mills et al., 2011; Pedro et al., 2018).

Sex education, sexuality education, SRE or RSE (nowadays the terms are largely used interchangeably at secondary level) has been taught in schools for over 150 years (Pilcher, 2005), with significant changes in the focus, extent and depth of teaching over time (Breuner et al., 2016; European Expert Group on Sexuality Education, 2016). It is acknowledged by both the World Health Organization (WHO) and the United Nations Educational, Scientific and Cultural Organization (UNESCO) that sex education is a necessary component of education (UNESCO, 2018; World Health Organization, 2010). It is widely agreed that the goal of sex education should be to support young people in their sexual development, while teaching the necessary skills to engage in healthy, safe relationships. Despite the widely recognized importance of high-quality sex education, the 2013 Office for Standards in Education, Children's Services and Skills (Ofsted) report found that Personal, Social and Health Education (PSHE) teaching needed improvement or was inadequate in 40% of English schools (Ofsted, 2013). More recent research, using a range of methodologies, has continued to identify shortcomings in sex education in England (Epps et al., 2023), Northern Ireland (Wilkinson, 2023), Scotland (MacGilleEathain, 2018) and Wales (Renold & McGeene, 2017). Our interest is in reproductive health. Both biology education and school sex education have the potential to contribute.

The first national statutory guidelines in England on SRE were published by the Department for Education and Employment in 2000 and did not require schools to teach reproductive health education (Department for Education & Employment, 2000). These remained unchanged for 20 years, until new statutory guidance was introduced in England in September 2020 (Department for Education, 2019). The new requirements include mandatory relationships education in primary school level and compulsory RSE in secondary

schools and include a reference for the need to teach 'the facts about reproductive health, including fertility, and the potential impact of lifestyle on fertility for men and women and menopause'. There is generally strong parental support in the UK and many other countries for school sex education (Kumar, 2020). There is robust evidence that high-quality RSE programmes delay initiation of sexual activity, decrease teenage pregnancy, abortion and STI rates, and increase the prevalence of condom and contraceptive use (European Expert Group on Sexuality Education, 2016; Macdowall et al., 2015).

Despite the fact that virtually all young people will experience the transitions of puberty and sexual development, many feel inadequately prepared (Tanton et al., 2015). It is imperative that good quality sex and reproductive health education are accessible and available to all young people, to empower them to make informed, safe choices (Goldman, 2012). The intention is to use the results of this study to improve reproductive health education by making educational resources in collaboration with the International Fertility Education Initiative (FEI) (Harper et al., 2021), in part by developing comprehensive, holistic educational resources. Ideally, sex and reproductive health education would be taught comprehensively across the RSE and science curricula. In order to improve school education, we need an understanding of what is currently included in the curricula and where the gaps lie.

Methodology

This study involved an investigation of the biology and science examination and relationships and sex education (RSE) and relationships, sexual health and parenthood education (RSHP) curricula in the UK for 14–18 year-olds as they relate to reproductive health. One reason for focusing on curricula is that there is no government control over textbooks in the UK. Accordingly, analysis of curricula (often referred to as 'specifications' when they are examination curricula) is the most effective way of analysing the intended curriculum. While intended curricula tell us neither what teaching is happening in classrooms (implemented curricula) nor what students have actually learnt (attained curricula), they do indicate what governments or examination boards have determined (intend) should be taught. One reason for including examination specifications is that, in common with many other countries, school examinations have come to play an increasingly important role in what

students are taught in the UK over the last 25 years (Pauw & Béneker, 2015; Reiss, 2000; Torrance, 2018). This study therefore provides an analysis of the documented curricula across the four nations of the UK; it does not attempt to audit the teaching in classrooms or the learning of students.

The only national examinations in school science in the UK are for students who are normally aged 16 and 18 in England, Northern Ireland and Wales and aged 15 and 17 in Scotland. As the school-leaving age in each of the four UK nations – England, Northern Ireland, Scotland and Wales – is 16, examinations for students aged 15 or 16 can be considered as school-leaving examinations, whereas those taken at age 17 or 18 are only for students who have remained in school/college education for a further two years. In England, Northern Ireland and Wales, we therefore analysed the GCSE (General Certificate of Secondary Education) science specifications, normally taken at age 16, and the A (Advanced) Level biology specifications, normally taken at age 18. In Scotland, the curricula for Nationals, normally taken at age 15, and Highers/Advanced Highers, normally taken at age 17, were analysed. The fact that students can choose to leave school at the age of 16 and that, if they stay, they have considerable choice as to which subjects they study means that only a minority of students study the post-16 curricula analysed here. For example, in 2022 in England, 65,262 students took A level Biology (Joint Council for Qualifications, 2022), which amounts to approximately 10% of the cohort.

The analysis was conducted using the most up-to-date and widely used specifications for the different examination boards (also known as 'Awarding Bodies') across the UK. The subject specifications are publicly available online and were accessed through the website of each examination board. The specifications include detailed information about what should be taught as part of the curriculum for each subject. Learning outcomes and practical skills required are specified for each topic area. Each specification for science and biology for the relevant age ranges was analysed using standard qualitative content analysis for topics relevant to relationships, reproduction, sexuality and fertility. Each specification was read in detail, and information about the inclusion (or otherwise) of topics relating to sexuality, reproduction, relationships or fertility was extracted. We used our professional judgement to decide which subtopics warranted inclusion.

In England, the National Curriculum lays down what needs to be taught for certain categories of

maintained (i.e. state) schools across the 5–16 age range. In reality, almost all schools align their curriculum with the National Curriculum. Accordingly, we decided to analyse the Key Stage 4 (for ages 14–16) National Curriculum science programmes of study. In Scotland, there is considerably more flexibility with regards to what is taught but the current Curriculum for Excellence has three core subjects that schools must ensure are taught: health and wellbeing, literacy and numeracy. We also analysed the new RSE guidance (Department for Education, 2019) which is available for England and in Scotland the advice and guidance on 'relationships, sexual health and parenthood education' (RSHP) (Scottish Government, 2014). This starts at the age of three and progresses throughout formal schooling. For consistency, the RSHP curriculum in Scotland was included for students aged 14–18; however, we acknowledge that there is significant teaching in relevant areas in Scotland prior to this age. At the time of writing, there was nothing comparable for Northern Ireland or Wales.

It is difficult to quantify the numbers of students who are taught particular reproductive health topics. This is because of (1) variation between the four UK nations, (2) examination boards vary in their coverage of reproductive health topics, (3) there are no published data on the numbers of students taking the examinations of different examination boards, (4) at GCSE (in England, Northern Ireland and Wales), different topics are included within Single, Double and Triple Award specifications, and (5) there are other (less widely taken) courses in addition to those analysed here, such as the International Baccalaureate. Our primary focus is on the curricula which all students study up to the end of compulsory schooling (age 16). We include data on examination courses in science to see if important topics are at least covered there, whether before the ending of compulsory schooling or after.

Results

In England there are three examination boards that set GCSE and A level examinations: the Assessment and Qualification Alliance (AQA); Oxford, Cambridge and RSA (OCR); and Pearson Edexcel. For 14–18-year-old school students, there is a single examination board in each of Northern Ireland (the Council for the Curriculum, Examinations and Assessment (CCEA)), Scotland (the Scottish Qualifications Authority (SQA)) and Wales (the Welsh Joint Education Committee (WJEC)). For the purposes of this study, we are

particularly interested in examinations set at the end of the compulsory age for schooling (age 16). In addition, the examinations set for 18-year-olds were analysed.

Specifications for students aged 16

Table 1 presents the findings of the specification analyses at age 16 for the National Curriculum Key Stage 4 science programmes of study and the six examination boards (GCSE and Nationals). The topics have been classified under three themes: relationships; sexuality; and fertility. All specifications for science examinations at age 16 were analysed. Some examination boards have multiple specifications for GCSEs. In particular, GCSE students can be entered for Single, Double or Triple Science (respectively giving them one, two or three GCSEs). This choice often depends on the ability of the student, as perceived by their teachers, with more capable students more likely to be entered for Triple Science. In addition, students sit GCSE science examinations at one of two tiers: foundation tier (targeted at GCSE grades 1–5) or higher tier (targeted at GCSE grades 4–9, with 9 being the top grade available at GCSE level). In Scotland, the National 5 qualification is more academically demanding than the National 4 qualification, which in turn is more academically demanding than the National 3 qualification. To further complicate matters, the boundaries between the four UK nations are not rigid with respect to the school examinations that students sit. In particular, a relatively small number of students in England sit examinations set by the Welsh board (WJEC), and some students in Scotland sit GCSEs.

Table 1 reveals some interesting similarities and differences between the four nations of the UK and between the three examination boards within England (AQA, OCR and Pearson Edexcel). Scotland is a clear outlier: gametogenesis and fertilisation are the only relationships, sexuality and fertility topics included with in the National 5 science specification, while the National 4 science specification has no such topics. In England and Northern Ireland (CCEA), the hormonal control of the menstrual cycle, contraception and ART are all taught within the human reproduction section of science. The level of detail varies between boards, and ART is often only included for higher tier students. Only the AQA specification includes the hormonal changes of puberty. The CCEA specification includes a wider range of topics than the other examination boards. Across England, Northern Ireland and Wales, STIs are used as examples of communicable diseases, while pregnancy is

only included in the GCSE specifications for Wales or England as a consequence of contraceptive failure.

Specifications for students aged 18

Table 2 presents the findings of the specification analyses at age 18. Scotland's Higher human biology specification contains topics such as hormonal control of reproduction, fertility and screening. Other Scottish biology specifications do not contain any topics relating to relationships, sexuality or fertility. Across the rest of the UK, the A Level specifications generally include fewer topics related to relationships, sexuality and fertility, compared with the GCSE specifications. The Welsh biology specification includes a range of topics, including anatomy, physiology, menstruation and birth. In Northern Ireland, the only topic related to sexuality is HIV as an example of a virus. In England, there is great variability across the examination boards, with no consistent topic inclusion. This variability may be connected to the fact that the official government requirements for A Level subject content do not stipulate any relationships, sexuality or fertility within biology (Department for Education, 2014).

Relationships and sex education curriculum

Table 3 highlights the key relationships, sexuality and fertility aspects of the English RSE and Scottish RSHP curricula at secondary school level. In September 2020, RSE teaching became compulsory in English secondary schools, based on national guidance (Department for Education, 2019). Each school is required to develop its own RSE policy in accordance with this guidance and most of these policies are not publicly available. Scotland has had an RSHP curriculum in schools for some time (Scottish Government, 2014). Both England and Scotland's curricula include a wide variety of appropriate topics, with the secondary RSHP curriculum in Scotland being part of a progressive programme throughout formal schooling. However, neither system is standardized across schools and teachers can choose which aspects to teach or omit.

Our findings across curricula in the four UK nations are summarized in **Table 4**. It is important to note that the RSE and RSHP curricula are not as clearly demarcated into age groups as are the science and biology curricula. In the case of Scotland, extensive resources for educators are available on the RSHP website

Table 1. Topics included in the Key Stage 4 National Curriculum for science and the science specifications (GCSEs in England, Northern Ireland and Wales; Nationals in Scotland) for each examination board as they relate to relationships, sexuality and fertility.

Theme	Topic	National Curriculum science key stage 4	AQA	OCR	Pearson Edexcel	CCEA	WJEC	SQA
Relationships Sexuality	STIs	✓	✓	✓	✓	✓ (Double Science and Triple Science)	✓ (Triple Science only)	
	HPV and cervical cancer							
Fertility	Hormonal aspects of reproduction	✓	✓	✓ (Triple Science only)	✓	✓		
	Hormonal and non-hormonal contraception	✓	✓	✓	✓	✓		
	Ethical aspects of contraception	✓	✓	✓	✓	✓		
	Menstrual cycle		✓	✓	✓	✓		
	Ovulation							
	Polycystic ovarian syndrome							
	Endometriosis		✓			✓		
	Hormonal changes at puberty		✓			✓		
	Causes of infertility		✓			✓		
	ART		✓	✓	✓	✓		✓ (National 5 only)
	Socioemotional considerations in ART							✓ (National 5 only)
	Ethical considerations in ART							
	Male and female reproductive anatomy							
	Gametogenesis							
	The process of fertilization							
	Pregnancy							
	Miscarriage							
	Abortion							
	The placenta						✓	
Aminion and amniotic fluid						✓		
Effect of alcohol on a fetus								
The use of monoclonal antibodies in pregnancy testing						✓ (Single Science only)		
The effect of age on the female and male reproductive systems								
Menopause								
Antenatal genetic screening, including amniocentesis			✓					
Ethical concerns with genetic screening								
Preimplantation genetic diagnosis								

AQA: Assessment and Qualification Alliance; OCR: Oxford, Cambridge and RSA; CCEA: Council for the curriculum, examinations and Assessment; WJEC: Welsh Joint Education Committee; SQA: Scottish Qualifications Authority.

Note: DfE *National Curriculum Science Key Stage 4* https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/381380/Science_KS4_PoS_7_November_2014.pdf; AQA *GCSE Biology (8461)*, 2016 <https://filestore.aqa.org.uk/resources/biology/specifications/AQA-8461-SP-2016.PDF>; GCSE *Combined Science: Trilogy (8464)*, 2019 <https://filestore.aqa.org.uk/resources/science/specifications/AQA-8464-SP-2016.PDF>; GCSE *Combined Science: Synergy (8465)*, 2019 <https://filestore.aqa.org.uk/resources/science/specifications/AQA-8465-SP-2016.PDF>; OCR *Twenty First Century Science Biology B J257*, 2020 <https://www.ocr.org.uk/images/234595-specification-accredited-gcse-twenty-first-century-science-suite-biology-b-j257.pdf>; GCSE (9-1) *Gateway Science Biology A J247*, 2020 <https://www.ocr.org.uk/images/234597-specification-accredited-gcse-twenty-first-century-science-suite-combined-science-a-j250.pdf>; Pearson Edexcel *GCSE (9-1) Biology*, 2016 https://qualifications.pearson.com/content/dam/pdf/GCSE/Science/2016/Specification/GCSE_Biology_Spec.pdf; CCEA *GCSE Double Award Science (1370)*, 2017. [https://ccea.org.uk/downloads/docs/Specifications/GCSE/2016/Specification/GCSE_DoubleAwardScience\(1370\).2017.pdf](https://ccea.org.uk/downloads/docs/Specifications/GCSE/2016/Specification/GCSE_DoubleAwardScience(1370).2017.pdf); *Award Science (1310)*, 2017. [https://ccea.org.uk/downloads/docs/Specifications/GCSE/2016/Specification/GCSE_AwardScience\(1310\).2017.pdf](https://ccea.org.uk/downloads/docs/Specifications/GCSE/2016/Specification/GCSE_AwardScience(1310).2017.pdf); WJEC *GCSE Biology*, 2019. <https://www.wjec.co.uk/media/aasic0sm/wjec-gcse-biology-spec-from-2016-e.pdf>; GCSE *Applied Science (Double Award)*, 2019. <https://www.wjec.co.uk/media/uy1haob5/wjec-gcse-applied-science-double-spec-from-2016.pdf>; GCSE *in Applied Science (Single Award)*, 2019 <https://www.wjec.co.uk/media/a4ebfry4/wjec-gcse-applied-science-single-spec-from-2016.pdf>; GCSE *in Science (Double Award)*, 2019. <https://www.wjec.co.uk/media/ikntmp5c/wjec-gcse-science-double-award-spec-from-2016.pdf>; SQA *National 3 Biology C707 73*, 2013. https://www.sqa.org.uk/files/nq/CFE_CoursesSpec_N3_Sciences_Biology.pdf; *National 4 Biology C707 74*, 2013. https://www.sqa.org.uk/files/nq/CFE_CoursesSpec_N4_Sciences_Biology.pdf; *National 5 Biology C807 75*, 2021. https://www.sqa.org.uk/files_ccc/N5CourseSpecBiology.pdf.

Table 2. Topics included in the biology specifications (a levels in England, Northern Ireland and Wales; Highers/advanced Highers in Scotland) for each examination board as they relate to relationships, sexuality and fertility.

Theme	Topic	AQA	OCR	Pearson Edexcel	CCEA	WJEC	SQA
Relationships Sexuality	STIs				✓ (HIV as an example of a virus)		
Fertility	HPV cervical cancer		✓ (Advancing biology only)				
	Hormonal aspects of reproduction					✓ (Including birth and lactation)	✓
	Hormonal and non-hormonal contraception						
	Ethical aspects of contraception						
	Menstrual cycle		✓ (Advancing biology only)				
	Ovulation						
	Polycystic ovarian syndrome		✓ (Advancing biology only)				
	Endometriosis						
	Hormonal changes at puberty						
	Causes of infertility						
	ART						
	Socioemotional considerations in ART						
Ethical considerations in ART							
Male and female reproductive anatomy							
Gametogenesis				✓			✓
The process of fertilization				✓ (As part of sexual reproduction in mammals)			✓
Pregnancy							
Miscarriage							
Abortion							
The placenta							
Amnion and amniotic fluid							
Effect of alcohol on a fetus							
The use of monoclonal antibodies in pregnancy testing			✓ (Advancing biology only)				
The effect of age on the female and male reproductive systems			✓ (Advancing biology only)				
Menopause							
Antenatal genetic screening, including amniocentesis				✓			✓
Ethical concerns with genetic screening				✓			
Preimplantation genetic diagnosis				✓			

AQA: Assessment and Qualification Alliance; OCR: Oxford, Cambridge and RSA; CCEA: Council for the Curriculum, Examinations and Assessment; WJEC: Welsh Joint Education Committee; SQA: Scottish Qualifications Authority.

Note: AQA AS and A-Level Biology (7401 and 7402), 2017 <https://filestore.aqa.org.uk/resources/biology/specifications/AQA-7401-7402-SP-2015.PDF>; OCR A Level Biology A H420, 2020 <https://www.ocr.org.uk/images/171736-specification-accredited-a-level-gce-biology-a-h420.pdf>; A Level Biology B (Advancing Biology) H422, 2020 <https://www.ocr.org.uk/images/171714-specification-accredited-a-level-biology-b-advancing-biology-h422.pdf>; Pearson Edexcel Level 3 Advanced GCE in Biology A (Salters-Nuffield) (9BN0), 2015 https://qualifications.pearson.com/content/dam/pdf/A%20Level/biology-a/2015/specification-and-sample-assessment-materials/9781446930885_GCE2015_A_Bio_A_spec.pdf; CCEA GCE Specification in Biology, 2017. <https://ccea.org.uk/downloads/docs/Specifications/GCE/GCE%20Biology%20%282016%29/GCE%20Biology%20%282016%29-specification-Standard.pdf>; WJEC GCE AS/A Level Biology, 2019. <https://www.wjec.co.uk/media/gcjtqvj/wjec-gce-biology-spec-from-2015.pdf>; SQA Higher Biology C807 76, 2019. https://www.sqa.org.uk/files_ccc/HigherCourseSpecBiology.pdf; Advanced Higher Biology C807 77, 2020. https://www.sqa.org.uk/files_ccc/AHCourseSpecBiology.pdf; Higher Human Biology C840 76, 2022 https://www.sqa.org.uk/files_ccc/h-course-spec-human-biology.pdf.

Table 3. Relationships, sexuality and fertility topics included in the statutory guidance for RSE in England and RSHP in Scotland at secondary school level.

Theme	Topic	England	Scotland	
Relationships	Families	✓		
	Respectful relationships (including friendships)	✓	✓	
	How and why to end a relationship		✓	
	Communication and dealing with conflict		✓	
	Abuse and relationships		✓	
	Marriage	✓		
	Parenting responsibilities	✓		
	Online and media	✓	✓	
	Being safe	✓	✓	
	Consent		✓	
	Gender equality		✓	
	LGBTQ + equality		✓	
	Disabilities and relationships		✓	
	Sexuality	Intimate and sexual relationships including sexual health	✓	✓
Identifying and managing sexual pressure		✓		
The choice to delay sex		✓		
Contraceptive choices		✓	✓	
STIs		✓		
Impact of alcohol and drugs on sexual relationships and behaviour		✓	✓	
Where to access advice about sexual health		✓	✓	
Pornography			✓	
Self-examination and sexual problems			✓	
Masturbation			✓	
Oral and anal sex			✓	
Prostitution and paying for sex			✓	
How people have sex			✓	
Having sex for the first time			✓	
Sexual rights			✓	
Fertility		Reproductive health and human fertility	✓	✓
		Impact of lifestyle on fertility	✓	
	Puberty	✓	✓	
	Menstruation		✓	
	Menopause	✓		
	Preparing for parenthood		✓	
	Being a parent/carer		✓	
	Getting pregnant		✓	
	Miscarriage	✓		
	Pregnancy	✓		
	Abortion	✓	✓	
Adoption	✓			

Note: DfE https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1019542/Relationships_Education_Relationships_and_Sex_Education_RSE_and_Health_Education.pdf; Scottish Government <https://rshp.scot/third-fourth-level/>, <https://rshp.scot/senior-phase/>.

(<https://rshp.scot>) on a range of topics that are not formally included in the curriculum.

Discussion

This study was conducted to understand the current level of reproductive health education in secondary schools in the UK, and to identify gaps. We compared the examination specifications for students aged 14–18 in the four UK nations on the grounds that formal examinations play a major role in what students are taught; in addition, Northern Ireland and Wales lack the RSE/RSHP curricula of England and Scotland (respectively). As Raffe et al. (1999) pointed out, ‘The differences among the four education systems of the UK are often perceived as a nuisance by comparative researchers’. Indeed, all too often, England is taken as a proxy for the UK. However, Raffe et al. (1999) argue

that these differences can also be seen as an opportunity for research, an approach we have taken here, in common with some others (Donnelly & Brown, 2022; Gray et al., 2022). Our results revealed significant differences in the content of the sex and reproductive health education curricula in the UK. There are deficits in the comprehensiveness with which relevant reproductive health topics are treated, as well as a lack of acknowledgement of sexual and reproductive health as an important facet of an individual’s overall well-being. High-quality education is required to foster sexual and reproductive health.

Specifications for 14–18 year-olds in the UK

Substantial variation exists between the requirements of the six examination boards in the UK in terms of how relationships, sexuality and fertility are covered in

Table 4. Summary table illustrating which topics are taught in any aspect of the curriculum across each of the four UK nations.

Theme	Topic	England	Scotland	Wales	Northern Ireland	
Relationships	Families	✓				
	Respectful relationships (including friendships)	✓	✓			
	How and why to end a relationship		✓			
	Communication and dealing with conflict		✓			
	Abuse and relationships		✓			
	Marriage	✓				
	Parenting responsibilities	✓				
	Online and media	✓	✓			
	Being safe	✓	✓			
	Consent		✓			
	Gender equality		✓			
	LGBTQ + equality		✓			
	Disabilities and relationships		✓			
	Sexuality	Intimate and sexual relationships including sexual health	✓	✓		
Identifying and managing sexual pressure		✓				
The choice to delay sex		✓				
Contraception		✓	✓		✓	
STIs		✓	✓	✓	✓	
Impact of alcohol and drugs on sexual relationships and behaviour		✓	✓			
Where to access advice about sexual health		✓	✓			
Pornography			✓			
Self-examination and sexual problems			✓			
Masturbation			✓			
Oral and anal sex			✓			
Prostitution and paying for sex			✓			
How people have sex			✓			
Having sex for the first time			✓			
Sexual rights			✓			
HPV and cervical cancer		✓				
Fertility		Reproductive health and human fertility	✓	✓	✓	✓
		Impact of lifestyle on fertility	✓			
		Puberty	✓			
	Menstruation		✓			
	Menstrual cycle	✓			✓	
	Menopause	✓				
	Preparing for parenthood		✓			
	Being a parent/carer		✓			
	Getting pregnant		✓			
	Miscarriage	✓				
	Pregnancy	✓				
	Abortion	✓	✓			
	Adoption	✓				
	Ethical aspects of contraception				✓	
	Ovulation					
	Polycystic ovarian syndrome					
	Endometriosis					
	Causes of infertility				✓	
	ART	✓			✓	
	Socioemotional considerations in ART	✓				
	Ethical considerations in ART	✓				
	Male and female reproductive anatomy	✓			✓	
	Gametogenesis	✓	✓	✓		
	The process of fertilization	✓	✓	✓	✓	
	The placenta				✓	
	Amnion and amniotic fluid				✓	
	Effect of alcohol on a fetus				✓	
The use of monoclonal antibodies in pregnancy testing	✓					
The effect of age on the female and male reproductive systems	✓					
Menopause						
Antenatal genetic screening, including amniocentesis	✓			✓		
Ethical concerns with genetic screening	✓			✓		
Preimplantation genetic diagnosis	✓					

science specifications for 14–16 year-olds (Table 1) and biology specifications for 16–18 year-olds (Table 2). For 14–16 year-olds, Northern Ireland's examination board, CCEA, includes the largest numbers of sexuality and fertility topics, while the Welsh board, WJEC, only includes STIs. Scotland has a comprehensive RSHP

programme as part of its curriculum. This covers a wide range of sex and reproductive health topics (Table 3). However, there is a risk that topics only included in the RSHP programme (and omitted from science specifications) may not always be taught to students. At the same time, all learners in Scottish

schools will be engaging in RSHP education regardless of whether they take a science subject from age 16 or not.

Our findings show that across the 14–18 age range specifications frequently include topics such as puberty, the menstrual cycle, contraception and STIs. However, there are many important topics, such as endometriosis, PCOS, fertility, preconception health, pregnancy, miscarriage, menopause, and infertility (except in the context of ART) that are missing from school science specifications. These topics are important for young people to understand, given their high prevalence within the adult population: menopause is an almost universal transition for women, while endometriosis (Rogers et al., 2009) and PCOS (Lauritsen et al., 2014; Rao et al., 2020) are experienced by approximately 10% and between 6 and 26% of women, respectively. Furthermore, miscarriage affects approximately a quarter of known pregnancies (NICE, 2021). Encouragingly, the topics of miscarriage and menopause are included in the RSHP curriculum in Scotland but are not in the RSE curriculum in England. By and large, the specifications are heteronormative, with little consideration of LGBTQ+ relationships, and do little to help students consider whether or not they would want to have children and what they might do if they found themselves pregnant but did not want to have children.

As many of the reproductive health education topics are multi-faceted, it is important to have a cohesive link between the science (biology) curriculum, particularly when this is compulsory for all students, and the RSE/RSHP curriculum so that students are taught these topics in a holistic and complementary way. For example, an understanding of STIs and how to prevent and manage them is essential to an individual's sexual health. STIs are included in the GCSE specifications of most UK examination boards. However, in the science specifications, there is no acknowledgement of sexual health as a significant facet of wellbeing, nor of the importance of young people understanding how to protect themselves from unwanted sexual health consequences. There is also nothing about the implications that STIs can have on individuals' lives or future fertility.

The importance of high-quality reproductive health education

The quality of reproductive health education has long-term health consequences, for both individuals and future generations. Preconception health issues in

adults can significantly impact the health of their children (Stephenson et al., 2018, 2019; The Lancet, 2018). Negative sexual health outcomes such as HIV, other STIs and unintended pregnancy also cause significant cost to the UK's National Health Service (NHS) (Health and Social Care (HSC) in Northern Ireland) (Department for Education & Skills, 2006; Ponsford et al., 2018). For these reasons, we see a role for the Department of Health and Social Care and Department for Education in England (and the equivalent departments in the other three nations) as stakeholders, alongside government education departments, teachers, parents and others, in determining what should be included within the reproductive health curriculum.

The lack of understanding around fertility has been well-studied in young adults. While concerns around infertility are common in young adults, understanding of the fertility implications of STIs, menstrual irregularities or obesity is often lacking (Lundsberg et al., 2014). There are also women (not to mention men) who do not appreciate the age-related fertility decline and who mistakenly believe that ART can be relied upon for them to have children using their own eggs even up until the menopause (Chauhan et al., 2021; Harper & Botero-Meneses, 2022). People often lack knowledge about the menstrual cycle and do not understand how to time sexual intercourse to maximize the chance of conception (Bull et al., 2019; Lundsberg et al., 2014). Such knowledge is fundamental to young people's ability to make informed reproductive health decisions.

Fertility education interventions can be effective in improving reproductive and fertility knowledge in young adults and reducing planned ages of childbearing (Boivin et al., 2018; 2018; Wojcieszek & Thompson, 2013). However, with only a single education intervention, these effects do not persist in the long-term (Daniluk & Koert, 2015). This supports the idea that it may be valuable to begin fertility education early and continue it throughout life.

School as a source of sex education

School has been identified as a key source of young people's sex education (Allen & Rasmussen, 2017; Barker et al., 2018; Macdowall et al., 2015). While other sources, such as friends, parents, the internet and TV, are also used by young people (Harper et al., 2021), school sex education provides an opportunity for near universal, standardized, high-quality sex and reproductive health education. This education would ideally

be universal, comprehensive, culturally appropriate and taught using a cohesive approach within both biology and an RSE/RSHP programme.

The association between sexual health outcomes and sources of adolescent sex education has been studied by several groups (Barrense-Dias et al., 2020; Macdowall et al., 2015; Tanton et al., 2015). Adults who report that school was their primary source of sex education during adolescence are more likely to have a later sexual debut and are less likely to have had an STI or to have engaged in risky sexual behaviour (Macdowall et al., 2015). For women, there was also an association between school as the main source of sex education and a lower chance of non-consensual sex, abortion or distressing sexual experiences (Macdowall et al., 2015). It is clear that formal sex and fertility education are important aspects of the school curriculum, a notion supported by both UNESCO (2018) and the World Health Organization (2010). Maslowski et al. (2022) found that the majority of young adults felt that fertility education should be part of the formal schooling curriculum.

At the same time, there are those who oppose school RSE. A frequent argument amongst those who object to school RSE is that it is parents who should provide their children's sex education (Barrense-Dias et al., 2020; Zimmerman, 2015). However, a 2015 study found that parents were the main source of sex education for only 7% of British males and 14% of British females aged 16–24 (Tanton et al., 2015). Recent data from Switzerland indicate that only 19% of young adults received their sex education mainly from school, but that these young adults had lower rates of STIs compared with those who learnt from their friends (Barrense-Dias et al., 2020). A recent Swedish study found that school-based fertility education is recommended since information about fertility was best received by secondary school students compared with other age groups (Bodin et al., 2021). Existing literature (Barrense-Dias et al., 2020; Bodin et al., 2021; Macdowall et al., 2015) suggests that high-quality sex education for school-age students requires collaboration between parents and schools and that parents should not be relied upon to deliver all of it.

Limitations

This study confines itself to examining the specifications of the secondary school examination subjects in England, Northern Ireland, Scotland and Wales that might include reproductive health education and to an examination of the RSE curriculum in England and

the RSHP in Scotland for 14–18 year-olds. Accordingly, our focus is on the intended curriculum. It would be valuable to look at other sources of the intended curriculum (notably textbooks and other materials used in schools) and examine what actually takes place in schools (the implemented curriculum) and what students learnt from this (the attained curriculum). Furthermore, much potential learning about reproductive health takes place in schools before the age of 14 and outside of schools. The fact that we used our professional judgement to decide which subtopics warranted inclusion introduces a degree of subjectivity into the analysis. In addition, we used standard qualitative content analysis to examine the various documents. It would be good to have a study that used critical discourse analysis; a critical discourse analysis of the sexuality education component of the National Australian Curriculum for Health and Physical Education helped identify a shift to a teacher-facilitated approach to sexuality education from earlier teacher-centred approaches (Ezer et al., 2019).

Conclusions and recommendations

We have found significant variation and gaps in the current UK science and biology curricula for 14–18 year-olds as they relate to sexual and reproductive health. At the same time, substantial numbers of young people are leaving school with inadequate understanding of concepts that have important implications for their sexual and reproductive health (Bunting et al., 2013; Macdowall et al., 2015). We see the potential for reproductive health education to be better aligned across RSE/RSHP and science curricula.

There have been many initiatives developed to improve sex and reproductive health education (Bailey et al., 2012; Mason-Jones et al., 2016; Oringanje et al., 2016). The UK Fertility Education Initiative (FEI) was founded in 2016, and aims to use fertility education to improve fertility awareness and outcomes (Harper et al., 2017). The goal is to develop comprehensive, reliable resources for teachers, parents, young people and health professionals to improve sex and fertility education. A global group of experts have recently (2020) formed an International FEI to evaluate knowledge and develop tools for improving fertility education (Harper et al., 2021). The Future of Sex Education Initiative in the US has been publishing National Sex Education Standards since 2012. Their most recent recommendations (Future of Sex Education Initiative, 2020) are based on seven topic strands: consent and healthy relationships; anatomy and physiology;

puberty and adolescent sexual development; gender identity and expression; sexual orientation and identity; sexual health; and interpersonal violence. These recommendations could be combined with Scotland's RSHP curriculum and adapted for use in the rest of UK to develop comprehensive, holistic guidelines that integrate RSE and science curricula.

We hope that the results of our study can be used by the FEI and IFEI to improve reproductive health education for young people by producing education resources. We also hope that, given the recent changes to RSE guidance in England, this study could be used as a baseline for further research into the effects of these changes.

Author contributions

Katherine Maslowski and Joyce Harper designed the study. Katherine prepared the data and drafted the paper. All authors contributed to writing and editing the paper.

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No potential conflict of interest was reported by the author(s).

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