Ageing gametes and embryonic death: a response to Bovens

Ashley Graham Kennedy

ABSTRACT

Luc Bovens, in his 2006 article, argues that it can be shown that the ‘rhythm’ method of birth control results in a larger number of embryonic deaths than the IUD, the morning after pill or the combination oral contraceptive pill, just so long as one accepts his three ‘plausible’ assumptions. In this brief response I will argue that Bovens’s third assumption is not plausible when one takes into account a basic knowledge of human reproductive biology. Thus, his argument, in both of its possible reconstructions, fails.

To begin, here are Bovens’ assumptions:

The first assumption is that there are a great number of conceptions that never result in missed menses. There are estimates that only 50% of conceptions actually lead to pregnancies. The second assumption is that, even in clinical trials, the rhythm method can fail due to the fact that a pregnancy results from sexual intercourse on the last days before and the first days after the prescribed abstinence period. Estimates of the effectiveness of the rhythm method vary in the literature, but let us set its effectiveness for clinical trials at 90%—that is, conscientious rhythm method users can expect one pregnancy in 10 woman years. The third assumption is that there is a greater chance that a conception will lead to a viable embryo if it occurs in the centre interval of the fertile period than if it occurs on the tail ends of the fertile period. This assumption is not backed up by empirical evidence, but does have a certain plausibility. From assumption one, we know that there is a high embryonic death rate. It seems reasonable to assume that an embryo that results from an ‘old’ ovum (that is waiting at the end of the fertile period) or an ‘old’ sperm (that is still lingering on from before ovulation), and that is trying to implant in a uterine wall that is not at its peak of receptivity, is less viable than an embryo that comes about in the centre interval of the fertile period. Let us make a conservative guess that the chance that an embryo conceived in the centre interval of the fertile period, which coincides with the abstinence period in the rhythm method—let us call this ‘the heightened fertility period’—is twice as likely to be viable as an embryo conceived at the tail ends of the fertile period.1

I agree with Bovens that the first two assumptions are plausible. It is the third that I wish to contradict. Bovens writes that it is plausible to assume that an embryo resulting from an ‘old’ ovum or an ‘old’ sperm will be less viable than an embryo that results from an ovum and a sperm that are both ‘young’. It is not clear from his article whether this reduction in viability is due to the age of the endometrium, which, as he writes, would not be at the ‘peak of its receptivity’, or whether this reduction is due to the age of the ovum or the sperm (or both). Either way his argument is construed, however, it fails.

First let’s take a look at the second construal. Suppose Bovens’ argument is that an ‘old’ egg or an ‘old’ sperm will, if joined in fertilisation, result in an embryo of reduced viability. To see the flaw in this assumption, we first need to take a look at what the term ‘old’ means when applied to human ova or sperm. It is well known that the maximum length of survival of human sperm inside the female reproductive tract is approximately 7 days, with a range of 1–7 days, while that of a human ovum is approximately 24 h, with a range of 12–24 h.2 Thus, while Bovens might want to qualify a sperm that has survived more than, say, 5 days as ‘old,’ it’s not possible to do the same for the ovum. Because of the short lifespan of the human ovum, we can safely say that it is never ‘old,’ given the restraints of the rhythm method. Allow me to elaborate. Because the rhythm method does not allow for intercourse either on the day of ovulation or on the day following ovulation, any ovum fertilised while using this method would have to result from a sperm ‘left over’ from intercourse prior to the determined fertile period. Thus, any conception that takes place in a user of the rhythm method would occur immediately after the release of an ovum from the follicle.3 Now, one might object to this argument along the following lines. Wilcox4 has found that an embryo conceived due to sex on the day of ovulation might be less viable than an embryo conceived due to sex prior to the day of ovulation. (No embryos are conceived via sex after the day of ovulation since the lifetime of an ovum is, at maximum, 24 h.) Therefore, women who have sex 5 days (the length of time sperm can live in the female reproductive tract) or less prior to ovulation are likely to conceive and become pregnant (assuming no extraneous fertility impairments). Women who have sex on the day of ovulation are also likely to conceive and yet might be at increased risk of loss of that conceptus, because sperm takes several hours to navigate the

---

1 Here I am using Bovens’ term. It should be noted, however, that the term ‘natural family planning’ is of more common usage. I take it that both terms are meant to describe what is known as the sympto-thermal method of conception control. The user of this method aims to prevent conception by avoiding intercourse during the ‘fertile period’, which are those days of the menstrual cycle 5 days before, and 2 days after ovulation during which the woman also has the adequate cervical mucus necessary for sperm transport.

2According to research from AJ Wilcox,3 this means that there would be fewer embryonic deaths for users of the rhythm method, than for users of any other method of birth control.
falloplian tubes and by the time it reaches the ovum, the ovum is 'old'. Therefore, any woman that conceives because of sex on the day of ovulation has a higher risk of embryonic death than a woman who conceives because of sex prior to the day of ovulation (sex after the day of ovulation never results in pregnancy, because an ovum can only survive 12–24 h). Now, the important point here is that if this is indeed an issue in reproductive medicine, it is not a problem specific to users of the rhythm method, unless these women are more likely than other women to have sex on the day of ovulation. And this seems very unlikely. Most likely, users of the rhythm will be less likely to have sex on the day of ovulation, since this is the very thing the method was designed to avoid. However, even if it turns out that rhythm method users have an equal likelihood of having sex on the day of ovulation (because the rate of correct estimation of the day of ovulation turns out to be no better than random guessing) then this is not a problem specific to rhythm method users and thus cannot be used as a criticism of the method. But there is another way that an embryo can be made less viable, on this construal of Bovens’ view. This is if it consists of an ovum that is fertilised by an ‘old’ sperm, one that has been waiting in the reproductive tract since prior to the fertile period. Now, then, the question we must evaluate is whether there is any way in which the age of the sperm could affect the viability of an embryo. After an egg and sperm join to form an embryo, the embryo must be transported down the fallopian tube and into the uterus where it has the potential to implant. Is it possible that the age of the sperm could affect the transport of the embryo? As it turns out, the answer is ‘no’. The age of the sperm does not affect the transport of the embryo. Rather, the rate of embryonic transfer is determined by the rate of contractions in the fallopian tube, which are in turn controlled by the levels of oestrogen and progesterone in the woman’s body.4 Thus, age of the gametes has no effect on embryonic viability. As expected, empirical research supports this point. A 1995 study published in the American Journal of Obstetrics and Gynecology found that ‘there is no excess risk of spontaneous abortion among the pregnancies conceived during natural family planning use’ even when those pregnancies occurred at the tail end of ovum viability:

Between 1987 and 1993, data on timing of conception and spontaneous abortion were collected from the charts of 286 natural family planning clients at five centres in the USA, Chile, Colombia (two sites) and Italy. This issue was investigated due to concerns that unplanned pregnancies arising from failures of the natural family planning method could be associated with aged gametes and adverse pregnancy outcomes. The day of peak mucus was used as the marker for estimating ovulation. The number of days from the most probable conception intercourse to probable day of ovulation provided an estimate of the time the gametes remained in the reproductive tract before fertilisation; less than 48 h was considered optimal. There were 88 spontaneous abortions (10.1%) and eight stillbirths (0.92%) in this series. Of the 361 conceptions judged to have occurred during the optimal time frame, 33 (9.1%) were spontaneously aborted. The miscarriage rate among the 507 conceptions that occurred at nonoptimal times was 10.9%. The difference was not statistically different.5

Thus, the second construal of Bovens’ argument fails.

Now, what about the first construal of the argument? It is common knowledge in reproductive biology that an inhospitably thin endometrial lining can prevent implantation and result in embryonic death. The question, then, is whether or not an endometrium that is past its ‘peak’ will be inhospitably thin. Because a human ovum can only survive a maximum of 24 h, we know that fertilisation must occur within 24 h of the release of the egg from the ovary; if it is to happen at all. Further, since menstruation generally occurs between 10 and 16 days after ovulation (in an ovulatory cycle), this means that, at maximum, the endometrium is retained for 15 days after fertilisation. Is there a thinning of the endometrium between mid cycle and end cycle that would make implantation less likely? Again, the answer is ‘no’. While the endometrium goes through a thickening process every menstrual cycle in preparation for possible implantation (and thus it is possible that the endometrium could be too ‘young’ to support implantation), there is no subsequent thinning on the tail end of the cycle. Rather, the endometrium is simply shed, during menstruation. Thus, while an older endometrium can be thicker than a younger one, it cannot be thinner. So while it is possible that an endometrial lining during any given cycle can be too thin to support implantation (because of a naturally occurring hormonal imbalance, or the use of hormonal contraception), the thickness of the endometrium does not decrease, but rather increases, with the number of days past ovulation. Therefore, the first construal of Bovens’ argument also fails.

Acknowledgements Many thanks to Luc Bovens, as well as to two reviewers from the Journal of Medical Ethics, for helping me to clarify the arguments presented here.

Competing interests None.

Provenance and peer review Not commissioned; externally peer reviewed.

REFERENCES

Ageing gametes and embryonic death: a response to Bovens

Ashley Graham Kennedy

*J Med Ethics* 2011 37: 571-572 originally published online April 8, 2011
doi: 10.1136/jme.2010.041608

Updated information and services can be found at:
http://jme.bmj.com/content/37/9/571.full.html

These include:

**References**
This article cites 4 articles, 2 of which can be accessed free at:
http://jme.bmj.com/content/37/9/571.full.html#ref-list-1

**Email alerting service**
Receive free email alerts when new articles cite this article. Sign up in the box at the top right corner of the online article.

Notes

To request permissions go to:
http://group.bmj.com/group/rights-licensing/permissions

To order reprints go to:
http://journals.bmj.com/cgi/reprintform

To subscribe to BMJ go to:
http://group.bmj.com/subscribe/