Comparison of self-reported female condom failure and biomarker-confirmed semen exposure

Supplementary Material

Section 1: Information on study-supplied lubricant

For the functionality study, subjects were provided with a 2.5 oz. (70.9 g) bottle of Astroglide®,

manufactured by BioFilm Inc, Vista, CA. For the NICHD efficacy substudy, participants were

provided with one 3 mL packet of a lubricant manufactured by Dahua which was designed to

have similar lubricant characteristics to those of Astroglide ®. Both the Dahua lubricant and the

Astroglide ® lubricant were found not to interfere with PSA assays conducted using the

ARCHITECT System (Abbott, Abbott Park, Illinois, USA) [24].

Section 2: Information on swube specifications

Falcon Swubes® (Becton Dickinson and Company) [25] consist of a 6-inch (15.2 cm) cotton-

tipped swab attached to the screw cap of a 16 x 150 mm clear plastic tube. The cotton-tipped

swab measured 5.2 mm in diameter and absorbed a mean of 384 µL of distilled water (SD 106

µL). A desiccant pellet was placed at the bottom of each tube after trimming the shaft of the

swab by approximately 1 cm.

Section 3. Subject swab collection

To minimize the likelihood that the precoital swab would contain PSA deposited from a previous

act of intercourse, subjects received instructions to abstain from intercourse for 48 hours before

using a study condom. Subjects collected the precoital vaginal swab immediately before inserting the study condom and the postcoital vaginal swab and condom swab as soon as possible after removing the study condom following intercourse.

To collect a vaginal sample, female subjects inserted the swab until feeling resistance, rotated the swab five times, and removed the swab from the vagina. The swab was then reinserted into the plastic tube and the cap tightened.

Following intercourse, subjects collected a semen sample from inside the condom by inserting the swab to the bottom of the WC interior or into the largest accumulation of semen within the condom. The swab was then reinserted into the plastic tube and the cap tightened.

Section 4: Description of laboratory procedures

Dried swabs were stored at room temperature, until they were extracted. Each swab was extracted by placing it in a labeled extraction tube containing 450uL of phosphate-buffered saline with 0.05% Tween20 (polysorbate20, a surfactant) for 30 minutes. The tube was then agitated using a Vortex machine. The resulting eluent was frozen at -80° C until the PSA assay was performed. After thawing, eluents were assayed using the ARCHITECT i2000_{SR} system (Abbott Diagnostics, Abbott Park, IL) [22, 26-27]. The ARCHITECT Total PSA assay is a Chemiluminescent Micro-particle Immunoassay (CMIA) for the quantitative determination of total PSA (both free PSA and PSA complexed to alpha-1-antichymotrypsin). This assay has a lower limit of quantification of 0.008 ng/ml [22].

Section 5: Definitions of semen exposure and clinical condom failure

We defined semen exposure as condom uses in which the postcoital vaginal PSA result was at least 22 ng/mL greater than the precoital vaginal PSA result. We chose a difference of 22 ng/mL because, in a previous study where duplicate vaginal samples were collected after inoculation with 1000 mL of semen, 95% of the duplicate samples varied by less than 22 ng/ml [16]. At least two other studies have used this criterion [13, 28].

Clinical female condom failure is defined as condom uses during which, by self-report, one or more of the following occurs: condom breaks during intercourse or withdrawal; condom completely slips out of the vagina during intercourse; misdirection (vaginal penetration whereby the penis is inserted between the condom and the vaginal wall); or invagination (part or entire external ring of the condom is pushed into vagina). This definition conforms to the standard list of terms and definitions developed by a WHO technical review committee in 2006 [5].

Section 6: Calculation of sensitivity and specificity

The calculation of sensitivity and specificity is a means of quantifying the loss of information about semen exposure when relying on reports of condom failure. The sensitivity of self-reported clinical failure is the number of condom uses with semen exposure and self-reported condom failure (breakage, slippage, misdirection, or invagination) divided by the number of uses with semen exposure. The specificity of self-reported clinical failure is the number of condom uses without either semen exposure or clinical failure (breakage, slippage, misdirection, or invagination) divided by the number of uses without semen exposure.

Section 7: Condom self-report form used in CONRAD Functionality Study

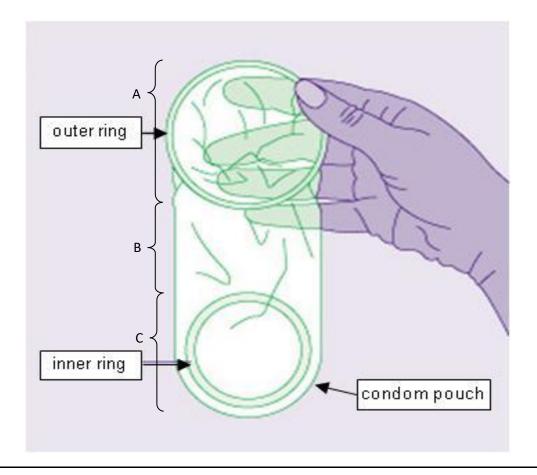
CONDOM USE QUESTIONNAIRE - 1 □ WC 2 □ FC2	Condom #
ID Female Birthdate	Date Used
OPENING & DONNING THE CONDOM	10. Did you add any other, non-study lubricant?
	₀ No
1. How did you open the condom package? (Check one.)	1 Yes, lubricant with spermicide (N-9 or nonoxynol-9)
With fingers 2 With sharp object (teeth, scissors, etc.)	Yes, Replens lubricant
3 Other, Describe:	Yes, other lubricant: Specify exact name:
2. Did the condom break or tear while opening the package?	
₀ No ₁ Yes: Answer Question 22 only.	11. While wearing this condom, which of the following sexual
	positions did you use? (Check all that apply.)
3. Did the condom appear to be in good condition?	1 Front entry, man on top
1 Yes 0 No, Explain:	Front entry, woman on top
	Rear vaginal entry, woman on knees
4. Was the condom inserted?	Rear vaginal entry, woman on side or stomach
1 Yes 0 No, Explain and answer Question 22 only:	1 Standing
	1 Anal intercourse
	1 Other, Explain:
5. When was the condom inserted?	1 - 1 - 1 - 1 - 1 - 1 - 1 - 1 - 1 - 1 -
Before intercourse started: minutes before	12. How long did you have vaginal intercourse
	while wearing this condom? minutes
2 After intercourse started: minutes after	write wearing titls condoin:
6. Who inserted the condom?	REMOVING & DISPOSING OF THE CONDOM
1 Woman 2 Man 3 Both	Namovino a sign conte of the contestin
1 VVOITAIT 2 IVIAIT 3 DOUT	13. How did you remove the condom?
7. How was the condom inserted?	Twisted the outer ring, and pulled the condom out
Inserted in vagina per instructions	Pulled the condom straight out (without twisting) 3 Other, Describe:
2 Put on penis first	3 Other, Describe:
3 Other, Describe:	44 During removal was there are anillars of comon?
INTERCOURSE INFO	14. During removal, was there any spillage of semen?
INTERCOURSE INFO	0 No 1 Yes, onto woman's genital area
	2 Yes, away from woman's genital area
8. Did you have vaginal intercourse using this condom?	
1 Yes 0 No, Explain and answer Question 22 only:	15. When did you remove the condom?
	Before intercourse ended: minutes before
	2 After intercourse ended: minutes after
9. Did you use the <u>study</u> lubricant during this condom use?	∪ Don't know/Not sure
(Check all that apply.)	
No, not used	16. How did you dispose of the condom?
On the penis: 1 Defore intercourse and/or 1 During intercourse	Put it in the trash 0 Other, Explain:
In the vagina: 1 ☐ Before intercourse and/or 1 ☐ During intercourse	
On the inside of the condom: 1 Before intercourse and/or	17. If you just used the Woman's Condom, in what condition
□ During intercourse	was the insertion capsule after removal of the condom?
On the outside of the condom: 1 Before intercourse and/or	N/A, used the FC2 Female Condom
1 During intercourse	Totally dissolved / could not see
. <u> </u>	Partially dissolved / could not see
	Not dissolved at all, Explain:
	4 Did not notice
	4 Did flot flotice
	D09-108 Condom Use © 7/21/1

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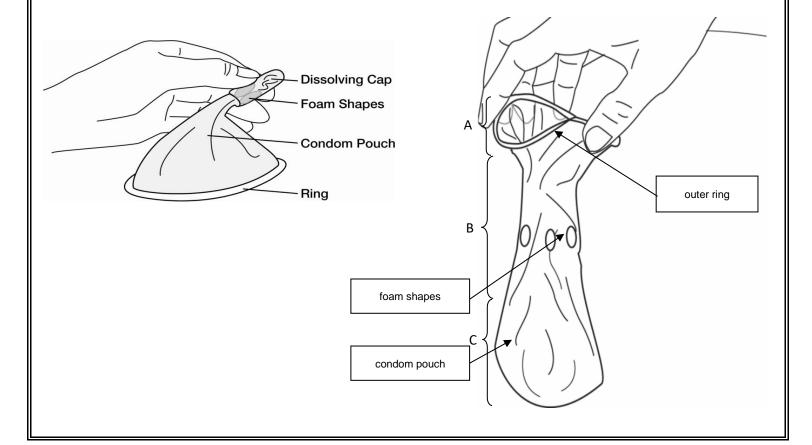
NoCal Only: ID-Condom:_ 18. Did the penis ever go between the condom and the 18a. What did you do when you noticed this problem? vagina? (Check all that apply.) (Check all that apply.) ₀ No: Skip to Question 19. Stopped intercourse, reinserted the penis into the condom, and continued 1 At insertion of the penis: 1 1 1 time or 2 1 More than once Continued intercourse without any attempt to adjust condom During intercourse: 1 D 1 time or 2 D More than once Removed the condom and continued intercourse without it U Don't know Removed the condom and stopped intercourse Other, Explain:_ 19. Did the outer ring of the condom ever get pushed into 19a. What did you do when you noticed this problem? the vagina? (Check all that apply.) No: Skip to Question 20. 1 Stopped intercourse, adjusted the condom, and continued Yes: 1 • 1 time or 2 • More than once Continued intercourse without any attempt to adjust condom Don't know Removed the condom and continued intercourse without it Removed the condom and stopped intercourse Other, Explain:_ 20. During intercourse, did the condom ever completely 20a. What did you do when you noticed this problem? SLIP OUT of the vagina? (Check all that apply.) No: Skip to Question 21. Stopped intercourse, reinserted the condom into the vagina, and continued Yes, clung to penis: 1 • 1 time or 2 • More than once Removed the condom and continued intercourse without it Yes, did not cling to penis: 1 • 1 time or 2 • More than once Removed the condom and stopped intercourse ∪ Don't know Other, Explain:_ 21. During withdrawal of the penis after intercourse, did the condom completely SLIP OUT of the vagina? 0 No 1 Yes, clung to penis Yes, did not cling to penis ∪ Don't know 22a. Where did the condom break? Check the answer that best applies. 22. Did the condom ever break? ₀ No: Skip to Question 23. Refer to diagram. Near outer ring- see Section A on diagram Yes, while opening package 2 Yes, after opening package but before inserting it 2 In the middle- see Section B on diagram 3 Yes, while trying to insert it At the tip- see Section C on diagram Yes, after inserting it but before intercourse began In more than one place Yes, during intercourse Yes, during withdrawal of penis from vagina 22b. If you just used the Woman's Condom, did the condom Yes, during removal of condom from vagina break along the seam? Don't know when N/A, used the FC2 Female Condom 9 Other, Describe :_ No, not along seam Yes, along seam

Don't know

FC2 Female Condom



Woman's Condom



SWAB COLLECTION

The BEFORE Vaginal Swab	
23. Did you collect the "BEFORE" swab from the vagina?	
1 Yes, before intercourse started	
Yes, but after intercourse started	
₀ No, did not collect the "BEFORE" swab, <i>Explain</i> :	
3 Other, Describe:	
The AFTER Vaginal Swab	
24. Did the male partner ejaculate into the vagina while using this condom?	?
1 Yes, when using the condom	
₂ No, ejaculated into the vagina when not using the condom, Explain:	
3 No, did not ejaculate into the vagina, <i>Explain:</i>	
25. Did you collect the "AFTER" swab from the vagina?	26. Did ejaculation occur <u>before</u> you took this swab?
1 Yes, before intercourse ended	1 Yes
2 Yes, after intercourse ended: How many minutes after:	2 No, ejaculated after taking the swab
o No, didn't take swab, <i>Explain and Skip to Q28:</i>	NNA, didn't ejaculate
o line, and the strate, explain and strip to 420.	NIVA, didit t ejaculate
NA, only took the "AFTER" swab NO NO Yes, before the condom was inserted Yes, after the condom was removed Yes, both before the condom was inserted AND after the condom was removed Other, Describe:	
The CONDOM Swab 28. Did you collect the "CONDOM" swab from the condom after intercourse	.2
1 Yes	: [
0 No	
2 Other, Describe:	
<u>-</u>	
The PREVIOUS Act of Intercourse	
29. Before this act of intercourse, how long ago was your last act of vagina	l intercourse (with or without a condom)?
1 In last 24 hours (in the last day) 3 48-72 hours ago (2-3 days ago	
2 24-47 hours ago (1-2 days ago) 4 More than 72 hours ago (more	than 3 days ago)
30. During that act of intercourse, which of the following occurred? (Mark	the answer that best applies.)
1 Finished intercourse with a condom (study or non-study)	
² Finished intercourse without a condom and ejaculated inside of the vagina	
3 Finished intercourse without a condom and did not ejaculate (or ejaculated outsid	de of the vagina)
31. Additional comments about this condom use:	

ID-Condom							
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Did you experience any of the following during or right after condom use?	If YES: How bad was the event at its worst?	When did the event begin?	How long after contact with the condom did this event last?	Do you know what might have caused the event?	Did you use any treatment for this problem?
32. Genital pain/discomfort	1 Mild	1 During condom use	1 Only while using condom	0 No	0 No
(burning, stinging, pressure)	2 Moderate	2 Right after condom use	2 1-10 minutes after	1 Yes, Describe:	Yes, Specify:
0 No 1 Yes	3 Severe		3 11-60 minutes after		·
		П	4 More than 1 hour after		
33. Genital itching	1 Mild	During condom use	Only while using condom	0 No	0 No
0 No 1 Yes	2 Moderate	2 Right after condom use	2 1-10 minutes after	1 Yes, Describe:	Yes, Specify:
	3 Severe		3 11-60 minutes after 4 More than 1 hour after		
24. Canital radinace arrest	. NAS-J	During and description		. Ne	
34. Genital redness or rash	1 Mild	During condom use	Only while using condom 1 1-10 minutes after	₀ No ₁ Yes, <i>Describe:</i>	□ No 1 Yes, <i>Specify:</i>
0 No 1 Yes	2 Moderate 3 Severe	2 Right after condom use	3 11-60 minutes after	1 1 es, Describe.	1 les, opecity.
	3 Oevere		4 More than 1 hour after		
35. Urinary pain/discomfort	1 Mild	During condom use	1 Only while using condom	0 No	0 No
(burning, stinging, pressure)	2 Moderate	2 Right after condom use	2 1-10 minutes after	1 Yes, Describe:	
₀ No 1 Yes ⇒	3 Severe	Z Tright and condom asc	3 11-60 minutes after	1	
			4 More than 1 hour after		
36. Pelvic/lower abdominal pain	1 Mild	1 During condom use	1 Only while using condom	0 No	₀ No
0 No 1 Yes □	2 Moderate	2 Right after condom use	2 1-10 minutes after	1 Yes, Describe:	
	3 Severe		3 11-60 minutes after		
			4 More than 1 hour after		
37. Vaginal spotting/bleeding	1 Mild	1 During condom use	1 Only while using condom	0 No	0 No
(not menstrual period)	2 Moderate	2 Right after condom use	2 1-10 minutes after	Yes, Describe:	Yes, Specify:
0 No 1 Yes □	3 Severe		3 11-60 minutes after		-
			4 More than 1 hour after		
38. Other, Specify:	1 Mild	1 During condom use	1 Only while using condom	0 No	0 No
<u></u>	2 Moderate	2 Right after condom use	2 1-10 minutes after	1 Yes, Describe:	1 Yes, Specify:
0 No 1 Yes □	3 Severe		3 11-60 minutes after		
			4 More than 1 hour after		

MEDICAL EVENTS - MALE PARTNER

NoCal Only: ID-Condom:	-

, , , , , , , , , , , , , , , , , , , ,	1 Mild 2 Moderate	During condom use			problem?
	2 Moderate		1 Only while using condom	0 No	0 No
0 No 1 Yes		2 Right after condom use	21-10 minutes after	1 Yes, Describe:	Yes, Specify:
	3 Severe		3 11-60 minutes after		
			4 More than 1 hour after		
40. Genital itching	1 Mild	1 During condom use	1 Only while using condom	0 No	0 No
0 No 1 Yes □	2 Moderate	2 Right after condom use	2 1-10 minutes after	1 Yes, Describe:	1 Yes, Specify:
	3 Severe		3 11-60 minutes after		
			4 More than 1 hour after		
11. Genital redness or rash	1 Mild	During condom use	Only while using condom	0 No	o No
0 No 1 Yes □	2 Moderate	Right after condom use	2 1-10 minutes after	1 Yes, Describe:	Yes, Specify:
	3 Severe		3 11-60 minutes after		
			4 More than 1 hour after		
12. Urinary pain/discomfort	1 Mild	During condom use	Only while using condom	0 No	o No
(burning, stinging, pressure)	2 Moderate	2 Right after condom use	2 1-10 minutes after	Yes, Describe:	Yes, Specify:
□ No □ Yes □	3 Severe	_	3 11-60 minutes after		
			4 More than 1 hour after		
3. Other, <i>Specify:</i>	1 Mild	1 During condom use	Only while using condom	0 No	o No
	2 Moderate	2 Right after condom use	2 1-10 minutes after	Yes, Describe:	
□ No 1 Yes ⇒	3 Severe	_ -	3 11-60 minutes after		
	_		4 More than 1 hour after		

RA: Date: / /		
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Section 8: Condom self-report form used in NICHD Efficacy Substudy

CONDOM USE QUESTIONNAIRE	Swab Set #
ID Female Birthdate	Date Used
INSTRUCTIONS This report should tell us about the study condom you were using when you <u>started</u> intercourse. If a condom is defective or torn when you open the package, do not use that condom and do not record its information here. If you remove the condom <u>before</u> you finish intercourse, be sure to take the after samples before you continue	3. Did you add any other, non-study lubricant? □□ No □□ Yes, lubricant with spermicide (N-9 or nonoxynol-9) □□ Yes, Replens lubricant □□ Yes, other lubricant □□ Yes, unsure if lubricant contained spermicide: □□ Specify exact name:
intercourse (with or without another condom). FEMALE CONDOM DIAGRAM Outer Ring	 4. While wearing this condom, which of the following sexual positions did you use? (Check all that apply) □ Front entry, man on top □ Front entry, woman on top □ Rear entry, woman on knees □ Rear entry, woman on side or stomach □ Standing □ Anal intercourse □ Other, Explain: 5. How long did you have vaginal intercourse while wearing this condom? Minutes
Foam Shapes C Condom Pouch INTERCOURSE INFO	 REMOVING THE CONDOM 6. How did you remove the condom? 1□ Twisted the outer ring, and pulled the condom out 2□ Pulled the condom straight out (without twisting) 3□ Other, Describe: 7. During removal, was there any spillage of semen? 1□ No 2□ Yes, onto woman's genital area 3□ Yes, away from woman's genital area
 1. When was the condom inserted? 1 Before intercourse started: minutes before 2 After intercourse started: minutes after 2. Did you use study lubricant during this condom use? (Check all that apply) 	8. When did you remove the condom? 1□ Before intercourse ended: minutes before 2□ After intercourse ended: minutes after ∪□ Don't know / Not sure
On the penis: □ In the vagina: □ On the inside of the condom: □ On the outside of the condom: □ On the outside of the condom: □ On the outside of the condom:	9. Additional comments about this condom use:

1□Before intercourse and/or 1□During intercourse

PRUBL	EINIS USING THE CONDOIN	• • • • • • • • • •	••••••		
10. Did the penis ever go <u>between</u> the condom and the		10a. What did you do when you noticed this problem?			
	gina? (Check all that apply)		Check all that apply)		
0□	No: Skip to Question 11	1□	Stopped intercourse, reinserted the penis into		
1	At insertion of penis:		the condom, and continued		
	1□ 1 time or 2□ More than once	1□	Continued intercourse without any attempt to		
1	During intercourse:		adjust condom		
.—	1□ 1 time or 2□ More than once	1□	Removed the condom		
υ□	Don't know	1 🗆	Other, Explain:		
<u> </u>		. —			
•••••	•••••	•••••	••••••		
	I the outer ring of the condom ever pushed <u>into</u>		(hat did you do when you noticed this problem?		
	vagina?	•	Check all that apply)		
0	No: Skip to Question 12	1 🗆	Stopped intercourse, adjusted the condom and		
10	Yes: 1□ 1 time of 2□ More than once	_	continued		
υ □	Don't know	1	Continued intercourse without any attempt to		
		_	adjust condom		
		1 🗆	Removed the condom		
		1 🗆	Other, Explain:		
	ring intercourse, did the condom ever completely		/hat did you do when you noticed this problem?		
	IP OUT of the vagina?	•	all that apply)		
0□	No: Skip to Question 13	1	Stopped intercourse, reinserted the condom		
1□	Yes, clung to penis:	_	into the vagina, and continued		
_	1 ☐ 1 time of 2 ☐ More than once	1	Did not replace the condom and continued		
1□	Yes, did not cling to penis:	_	without it		
_	1 ☐ 1 time of 2 ☐ More than once	1□	Did not replace the condom and stopped		
υ □	Don't know	_	intercourse		
		1 🗆	Other, Explain:		
•••••		••••••			
	<u>ring withdrawal</u> of the penis <u>after</u> intercourse, did th	e condom	completely SLIP OUT of the vagina?		
0	No				
1	Yes, clung to penis				
2□	Yes, did not cling to penis				
υ□	Don't know				
•••••	••••••	••••••	••••••		
14. <i>Dia</i>	I the condom ever break?		here did the condom break? (Check the answer		
0	No: Skip to Question 15	tř	nat best applies. Refer to diagram.)		
5□	Yes, during intercourse	1□	Near outer ring – see Section A on diagram		
6□	Yes, during withdraval of penis from vagina	2□	In the middle – see Section B on diagram		
7□	Yes, during removal of condom from vagina	3□	At the tip – see Section C on diagram		
8□	Don't know when	4□	In more than one place		
9□	Other, Describe:	445 5	id the condem by a live the constant		
			id the condom break along the seam?		
		0□	No, not along seam		
		10	Yes, along seam		
		υ 	Don't know		

SWAB COLLECTION	ID-Swab Set #
The BEFORE Vaginal Swab	
3□ Other, Describe:	
The AFTER Vaginal Swab	
 16. Did the male partner ejaculate into the vagina while us 1□ Yes, when using this condom 2□ No, ejaculated into the vagina when not using this 3□ No, did not ejaculate into the vagina, Explain: 	s condom, Explain:
17. Did you collect the "AFTER" swab from the vagina? □ Yes, before intercourse ended □ Yes, after intercourse ended: How many minutes after: □ 3□ No, didn't take swab, Explain and Skip to Q21:	 18. Did ejaculation occur <u>before</u> you took this swab? □ Yes □ No, ejaculated after taking the swab N□ NA, didn't ejaculate
 19. Did you have any unprotected intercourse between the time you collected the "BEFORE" and "AFTER" swabs? N□ NA, only took the "AFTER" swab: Skip to Q21 0□ No 1□ Yes, before this condom was inserted 2□ Yes, after this condom was removed 3□ Yes, both before this condom was inserted AND after this condom was removed 4□ Other, Describe: 	 20. Did you use another study condom or any other method between the time you collected the "BEFORE" and "AFTER" swabs? (Check all that apply) □ No □ Yes, after this condom was removed 4□ Other, Describe:
The CONDOM Swab	
21. Did you collect the "CONDOM" swab from this condon 1□ Yes 0□ No 2□ Other, Describer:	
The PREVIOUS Act of Intercourse	
` ` ` ` ` ` ` ` ` ` ` ` ` ` ` ` ` ` ` `	last act of vaginal intercourse (with or without a condom)? 2 hours ago (2-3 days ago) e than 72 hours ago (more than 3 days ago)
23. During that act, which of the following occurred? (Mark- □ Finished intercourse with a condom (study or non □ Finished intercourse with another barrier method □ Finished intercourse without a method and ejacula □ Finished intercourse without a method and did no	n-study) like a diaphragm, cap or spermicide lated inside the vagina