ARE CONDOMS THE RIGHT SIZE(S)? A METHOD FOR SELF-MEASUREMENT OF THE ERECT PENIS

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Abstract

As part of a study investigating the adequacy of the Australian Standard for latex condoms, we arranged for self-measurement of the erect penis by a volunteer sample of 156 men, predominantly Caucasian. The kits contained illustrated instructions and paper tapes which the respondents mailed back to us marked with creases to indicate their dimensions. Mean penis length was 16.0 cm (95% confidence interval (CI) 12.2–19.8 cm) and circumferences were: base 13.5 cm (95% CI 10.7–16.2 cm); shaft just below coronal ridge 12.4 cm (95% CI 10.0–14.8 cm); glans 11.9 cm (95% CI 9.6–14.2 cm). Repeat measures of 15 men showed intra-class correlations (r) of 0.90 for length, 0.68 base circumference, 0.87 behind ridge and 0.87 glans. Non-users of condoms were more likely to have narrower penises. In a subsample of 66 men who reported on perceived condom comfort, men with wider penises (base circumference) were more likely to find condoms too tight. Men with longer penises were more likely to complain that condoms were too short. Circumcised men had shorter erect penises than uncircumcised men ($p<0.05$). The paper recommends that the measurement technique described in this study should be applied to other populations, and that condoms should be manufactured and marketed in a wider range of lengths and widths.

Introduction

In order to be effective at a public health level, condoms should be available in size ranges that are acceptable to as many men as possible. Questionnaire-derived data indicate that this is not the case. Ross found that 27% of a sample of gay men reported that condoms were too small and 3% reported that they were too large.[1] De Graaf et al. reported that 36% of a group of female prostitutes and 13% of prostitutes' clients expressed a need for either smaller or larger condoms.[2] Sparrow and Lavill's respondents found condoms too small on 7.4% of occasions of use and too large on 1.1% of occasions.[3] Whether a condom fits well on a particular man depends on the condom size relative to his erect penis size, the elasticity of the rubber, the shape of the condom and the tightness of the rim. Whether he finds the condom comfortable is of course subjective.

The few published studies of the size of erect male penises had the objective of determining normal growth ranges rather than evaluating the adequacy of condom sizes. In the 1940s Schonfeld and Beebe reported genital measurements of about 1500 white American boys and young men aged 0 to 25 years.[4,5] For men aged 18 to 25 (n=125), their figures give an estimated median erect penis length of 13.1 cm (80% confidence interval (CI) 11.1 to 15.5 cm) and a circumference at the widest point of about 11.4 cm (80% CI 9.4 to 13.2). Erect length and circumference were calculated from dimensions of the stretched flaccid penis by formulae derived from self-measurement of the erect penis by a subsample of 150 males.

The much-quoted Kinsey data were based on self-measurement with a ruler.[6] Respondents were asked simply to measure their erect penis on the top surface from belly to tip and the circumference at its widest point and write the answer to the nearest quarter of an inch on a reply-paid card. There was room for misunderstanding of these instructions and evidence of digit preference (to round inches and half-inches) in the published results. No information on the accuracy of the method was offered by the authors. From their tables a mean length of 15.7 cm (95% CI 12.0 to 19.3 cm) and circumference of 12.3 cm (95% CI 8.8 to 15.7) can be calculated for their sample of about 2500 men, of whom about 2% were black.

Accepting Schonfeld's principle that the length of the stretched flaccid penis predicts its erect length, Money et al. reported findings from a convenience sample of 65 professional colleagues and other adult acquaintances.[7] They determined a mean length of 16.7 cm (± 1.9 cm SD), range 11.4 to 20.3 cm. Interestingly, Money's group found no association between body height or weight and penis length. Penile circumference was not measured in this study. More relevantly, Muangman recruited three female prostitutes in Thailand who measured 527 clients aged 18 to 55 from symphysis pubis to the tip of the glans and around the circumference at the base with paper tapes.[8] The mean penis length was 13.1 cm (range 7.6 cm to 19.1 cm) and the mean circumference at the base was 10.9 cm (range 9.9 cm to 14.0 cm). Muangman pointed out that this is considerably smaller than the sizes reported by Kinsey. He concluded that American condoms were too large for Thai men.

With the objective of investigating the adequacy of the Australian Standard for latex condoms, we set out to obtain measurements of the erect penises of a sample of Australian men. Initially we attempted to follow Muangman's method, so we recruited and trained a group of female prostitutes who

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were willing to measure consecutive clients. However, this was not successful. Almost all of the clients who were asked to participate in pilot-testing of the measuring kit refused. Pilot testing also revealed that the sex workers had not understood the importance of asking every man, not only those likely to comply. The workers found that in practice they were unwilling to ask a client if he was nervous or had a small penis and they suspected he might be sensitive about it. Therefore we adapted Muangman's measurement technique for self-application and distributed kits to men to use at home, accepting that this voluntary and anonymous approach meant that the sample was not representative. The resulting data were then compared with i) subjective reports of condom fit; and ii) the dimensions of condoms available on the Australian market and those allowed by condom Standards.

Methods

Penis measuring kits were distributed to 410 men responding to a clinic-based survey on condom use,[9] of whom 121 men returned measurements to us, a response rate of 30%. We recruited a further 35 volunteers by word of mouth, giving a total sample of 156 men. Of these, 147 completed questionnaires including details of age, circumcision status and condom use experience and intentions and reasons for non-use.

Measurement method

The penis measuring kit consisted of four coloured paper tapes, illustrated instructions (Figure 1) and a reply-paid envelope. The tapes were labelled but bore no measurements. The glans tape was about 2 cm wide and the others about 1 cm wide. The length tape was 29.7 cm long and the circumference tapes 21.0 cm. Participants were asked to measure the length of the erect penis (anterior surface from symphysis pubis to urethral meatus) and its girth in three places: at the base of the shaft, around the glans, and around the shaft just below the coronal sulcus. This was achieved by passing the tape around or along the relevant part and creasing it at the point where it met. The base circumference was measured one finger-width from the symphysis in order i) to avoid including the anterior scrotal wall; ii) to avoid entanglement in the pubes; and iii) to best approximate the position of the condom rim.

Respondents were also asked to crease the length tape twice so as to show length of shaft from base to the coronal sulcus, but 39% of them failed to do this satisfactorily. Total length measurements only have been reported below. The creased tapes were then posted anonymously back to the researchers. Each tape was stamped with a kit number so that it could be correlated with the questionnaire responses from the same man. The measurement indicated by the creased tape was ascertained by holding it along a ruler and recording the measurement to the nearest millimetre. Fifteen of the men measured themselves on two occasions to allow us to check the method for reliability.

Figure 1: Penis self-measuring instructions (50% reduction)

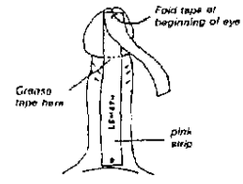
INSTRUCTIONS

In this kit you will find four strips of coloured paper. You will use them to record the length of your penis and the distance around it (circumference) at three points. For each width measurement, keep the tape in contact with the skin all the way round, but do not squeeze the penis.

Your penis needs to be erect (hard). Do not worry if it is not as big as it sometimes gets; the aim is to measure it at the size it would be if you were about to put on a condom.

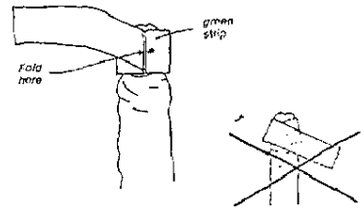
1. Length

Place the PINK strip on the upper surface of your penis with the dot end at the base of the penis against your body. Crease the tape at the ridge under the head of your penis and again near the tip of your penis, at the beginning of the 'eye'.



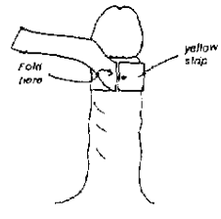
2. Width of head of penis (Knob)

Wrap the GREEN strip around the widest part of the head of your penis, starting at the dot end. Crease the tape straight across at the point where it meets. Keep the tape straight, at right angles to the shaft of the penis (see diagram); do not angle it to fit around the head of the penis.



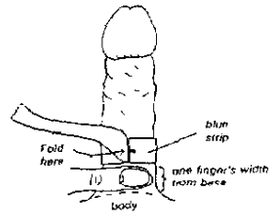
3. Width of penis behind ridge

Wrap the YELLOW strip around the shaft of the penis just behind the ridge (i.e., just below the head), starting at the dot end. Crease the tape at the point where it meets.



4. Width of penis at base

Place one finger at the base of your penis against your pubic bone and wrap the BLUE tape around the penis one finger's width from your body. Start at the dot end and crease the tape at the point where it meets.



Analysis

Results were analysed for significant differences in means using t-tests. As a measure of overall size we calculated a 'putative volume' for each penis. This was arrived at by regarding the penis as a cylinder with a hemisphere at one end. The radius of the cylinder was calculated from the average of the three circumference measurements and the radius of the hemisphere from the glans circumference measurement alone. The repeat measures were analysed using intra-class correlation to calculate r.[10] (This is a measure of association where perfect agreement between the two sets of measurements would give a coefficient of one, and disagreements, either systematic or random, would reduce the coefficient.)

Results

Erect penis measurements were available from 156 men and questionnaire responses were available for 147 men (94%). Ages ranged from 18 to 55 years, with an average (mean and median) of 33 years. Asked about condom use, 114 said they were regular or occasional users, 22 were current non-users and 11 had never used one (the most common reason given was 'No need—my partner(s) are safe'). As 151 (97%) of the study group were Caucasian, interracial comparisons were precluded.

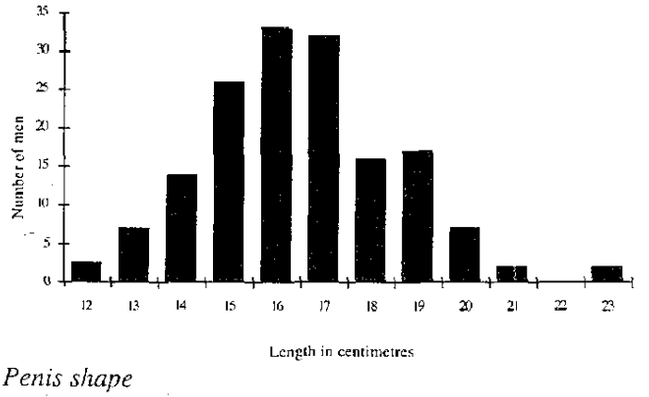
Penis dimensions

Mean dimensions are shown in Table 1 and Figures 2 to 5.

Table 1: Erect penis dimensions of 156 volunteers

Dimension	Range	Mean	95% confidence interval
	cm	cm	cm
Length	11.7 to 22.5	15.99	12.16 to 19.82
Circumference at base	10.5 to 17.5	13.47	10.72 to 16.22
Circumference of shaft below ridge	8.7 to 16.1	12.40	9.96 to 14.85
Circumference of glans	9.3 to 16.0	11.93	9.62 to 14.24

Figure 2: Length of erect penis (n=156)



Penis shape

As can be seen from the mean dimensions, penises on average had a slightly conical shape, i.e., the base circumference was 9 mm larger than the shaft behind the coronal ridge, which was in turn 5 mm larger than the glans. However, there was considerable individual variation. Some men had more or less cylindrical penises and a few had a glans penis circumference larger than the base of the shaft.

Figure 3: Circumference at base of erect penis (n=156)

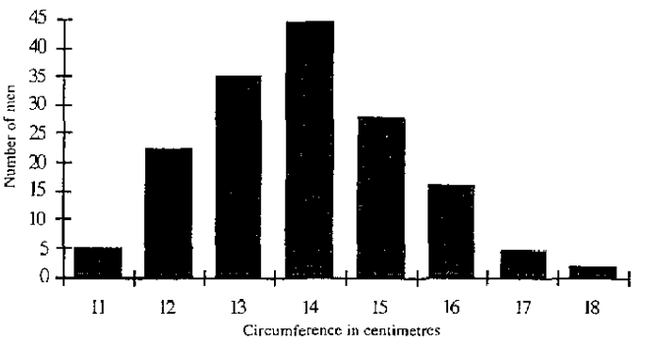


Figure 4: Circumference of shaft behind coronal ridge of erect penis (n=155)

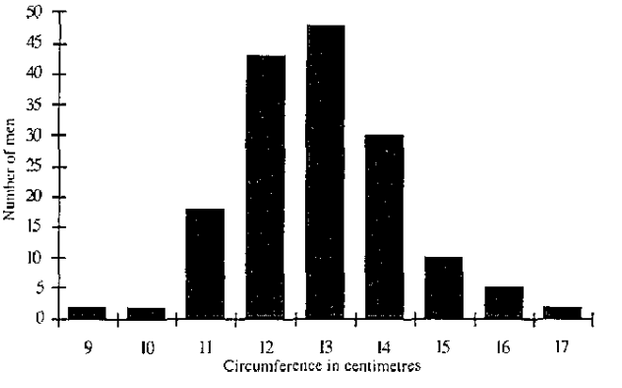
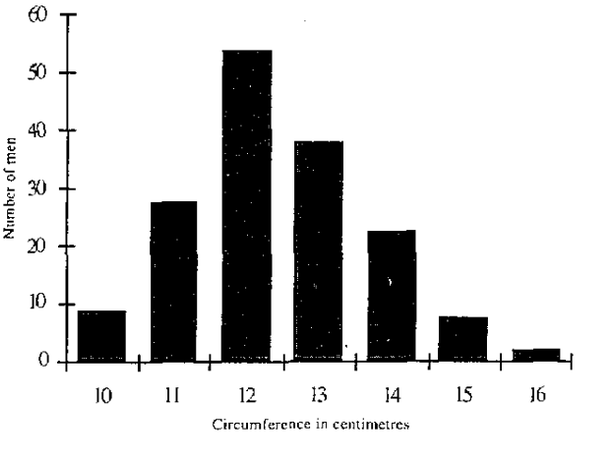


Figure 5: Circumference of glans penis during erection (n=155)



Repeat measures

Repeat measures on 15 men showed a high degree of correlation, with intra-class correlations (r) of 0.90 for length, 0.68 for base circumference, 0.87 for behind the coronal ridge and 0.87 for the glans measurements. It is not possible to distinguish between measurement error and actual variation in erect penis size on different occasions.

Circumcision

One hundred and two were circumcised, 43 were not, and two men did not answer. The uncircumcised penises had slightly larger circumferences, but the difference was not significant (2 mm behind the coronal ridge and 4 mm at the glans). There was a significant difference in length, with the uncircumcised men having a mean length 8 mm greater than the circumcised ($t=2.06$, $p<0.05$). Insufficient residual foreskin in some circumcised men may have tethered their erections.

Condom use

Non-users (n=33) had significantly narrower penises on average than users (n=114), with a difference in the circumference at base (means 13.62 cm and 13.06 cm; $t=1.98$; $p<0.05$) and in the average of the three circumferences (means 12.71 cm and 12.27 cm; $t=2.05$; $p<0.05$).

Perception of condom size and comfort

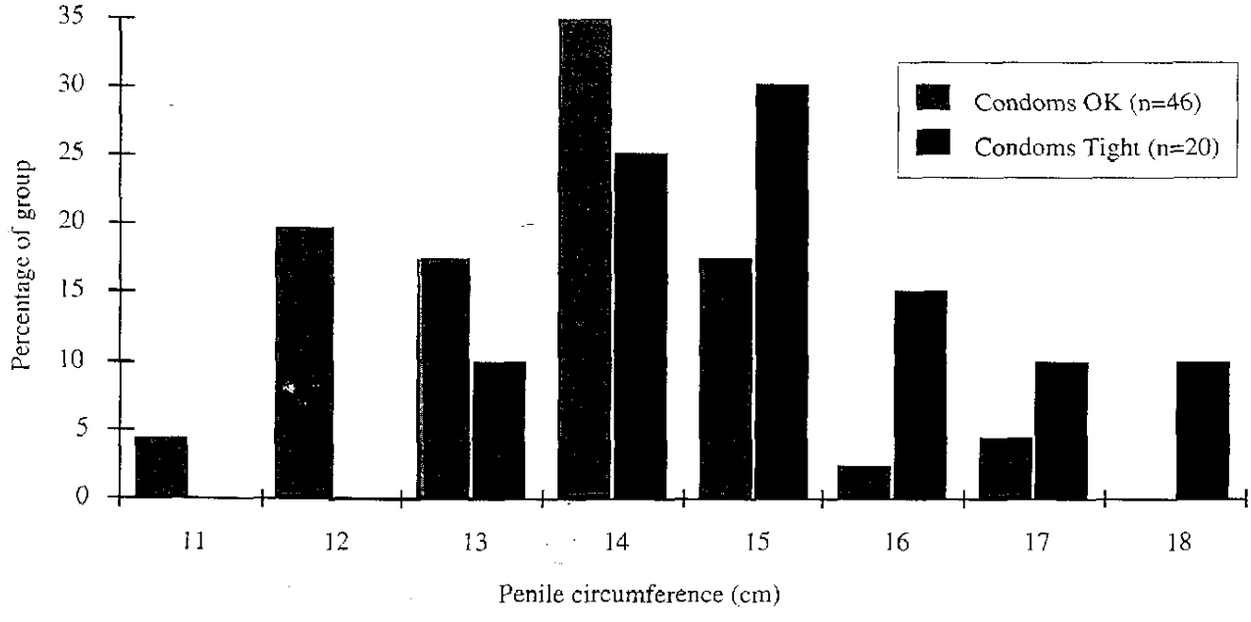
Sixty-six of the respondents also took part in an overlapping study of user-related reasons for condom failure[11] and reported on their perception of condom fit and comfort. Measured base penis circumference and perception of condom tightness were related. The mean difference between the group complaining of tightness and those satisfied with the condom circumference was 1.47 cm (95% CI 0.7 to 2.2 cm). In this comparison, all complaints about tightness, at the rim or all over, were treated as equivalent, and the circumference at base was used as the sole size parameter. The two distributions of penis circumference (men reporting tightness and men satisfied) are shown in Figure 6. There were a few anomalous cases of men with large penises not finding condoms too tight, but none of the men who complained of tightness were in the two smallest circumference classes. While significant, the correlation between putative volume and complaints of fit was not as good as the correlation with circumference (data not shown).

Discussion

Given the low response rate from clinic recruitment (30%) and the convenience sampling of the rest of the study group, we consider that these data should be regarded as based on a volunteer study population. Non-Caucasian men (3%) were underrepresented. Men with very small penises may have found the size of the measuring tapes intimidating or unworkable. Despite their anonymity, men with smaller penises may have been more likely than others to exclude themselves because of embarrassment. While a truly representative sample of men would be ideal this proved to be beyond us. Our attempt at repeating Muangman's approach[8] of having prostitutes measure clients proved a dismal failure. Perhaps future workers can complement our findings with studies of different populations using this self-measurement technique.

Nevertheless our measurements were distributed approximately normally (Figures 2 to 5), as would be expected for most series of biological measurements. The mean circumference and length measurements compared closely with the Kinsey data.[6] As the Kinsey data show a long left-hand tail on the distribution of circumferences, we suspect that some of their subjects may have misunderstood the instructions and measured penile diameter rather than circumference. Muangman's Thai group (measured in a similar manner to our group) had smaller penile lengths and base circumferences. Schonfeld and Beebe's reported mean penile lengths[5] were shorter than our sample. There are several possible explanations. Firstly, the measurement techniques may not be comparable, and the stretched flaccid penis length may not reliably predict the erect length. Poorer nutrition 50 years ago could have limited growth, but this should also have been true of the Kinsey series. It is likely that men with smaller penises excluded themselves from both the Kinsey sample and ours, and Schonfeld's was more representative of the population at large.

Figure 6: Base circumference of the erect penis and perceived condom fit (n=66)



The correlation between perception of condom fit and penis size is confounded by several issues: i) some men may have sought out condom sizes that suited them better, while others may not; ii) some may be less sensitive than others to the pressure of a tight condom, indeed, some may prefer a tight fit; iii) negative attitudes tow ·rds condoms that may make some men more aware of them or more inclined to complain; and iv) possibly men with a narrow glans penis may find it slips into the teat of the condom, causing localised restriction.

A year before this study we conducted a retail market survey of all condoms available in Australia.[12] Condom circumferences (calculated as twice the measured width of the condom laid flat) ranged from 9.0 to 11.2 cm. The International Standard for Condoms (ISO 4074), adopted in 1990, allows for condoms to fall within the range 8.8 to 11.2 cm (flat width 44 to 56 mm). The major condom brands found in our market survey (those sold widely, and covering well over 90% of total sales) were clustered near the upper end of the permitted circumference, from 10.2 to 11.2 cm. These condoms can accommodate all the penises in our sample, but those with larger penises may find the condoms uncomfortably tight. However, it should be noted that on some of Muangman's Thai men, and on a few members of our sample, Australian condoms would be too wide to maintain a grip on the penis. Muangman noted that some men tied American condoms on with string. In our study, men who did not use condoms had narrower penises than condom users. This may be a reason for some men to avoid condoms.

There were no complaints about condoms being too long. This is probably because men with shorter penises can unroll only as much of the condom as is necessary. In extreme cases, men with very short but not narrow penises might find so much of the condom still rolled up that it would cause tightness. On the other hand, there were complaints about condoms being too short, and these correlated with longer penis measurements. At the time of the study, the major condom lines in Australia averaged around 17 (or more commonly 18) to 19 cm in length, but some individual condoms were as short as 16.6 cm. Only nine men in our study (6%) had penises longer than 19 cm, but 42 had penises longer than 17 cm. The principal effect is the mismatch of the two measured lengths.

Long penises tend to have larger circumferences. The issue of condom length is compounded by the fact that when a condom is unrolled onto a very large circumference penis, the condom may shorten slightly, as all materials do when stretched. Also, the condom may be more difficult to unroll onto a very large circumference penis, and this may cause some gathering of the rubber instead of smooth unrolling. Some refinement of the concept of penis volume may prove useful in further investigations of this issue.

We believe that our penis self-measurement technique is reasonably reproducible. However, it requires reading skills, a reliable erection and a high degree of motivation on the part of the subjects. The deletion of the measurement from symphysis pubis to coronal sulcus, and perhaps one of the circumference measurements, should simplify the process further. We hope that future investigators will be able to measure more racially diverse and representative samples.

A new version of the ISO condom standard, still in draft form when this article was written, abolishes the restrictions on condom circumference, responding to suggestions made by other authors.[13,14] A significant minority of our subjects apparently had good reason to complain about condoms being too small. Wider condoms are available in the USA, but so far, not in Australia.

The sample was primarily Caucasian in origin. A significant minority of Australia's population now originates from countries where smaller condoms are the norm, and, although this study did not address that issue, it appears that if condom use is to be practical for all Australian men, narrower condoms should also be available. Slippage in use, discussed elsewhere,[9,11] may also be related to inadequate tightness of fit.

We do not know which brands of condoms were the sources of complaints about size. At the time of the study, there were no brands sold in Australia that offered a range of sizes, though there were variations between brands (in the range 4.6 to 5.6 cm flat width). Unfortunately, these sizes were not indicated on the packets, so consumers had no way of knowing about them in advance. Some brands also offered a range of shapes (eg waisted). The narrower condoms were difficult to find on the retail market. In 1991, the Australian Government adopted the ISO condom standard, requiring the flat condom width to be marked on the pack. When this article was published, the market was still focussed on a very narrow range of sizes, between 5.2 and 5.5 cm. It is to be hoped that a wider range will become available to Australian consumers in the future.

Acknowledgments

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