Predictors of Anemia Among Non Pregnant Married Women in a Peri-urban Coastal Slum of Karachi, Pakistan

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Research article

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Abstract

Background

Under-nutrition is a global public health threat, to which pregnant and lactating mothers are particularly susceptible. An estimated 468.4 million women (17%) of child bearing age have anemia, and this figure is as high as 50% of women of childbearing age in developing countries. Factors like substance abuse, nutritional habits, hygiene, reproductive health status and socio-cultural factors are associated with high prevalence of anemia among women. The aim of the study was to determine prevalence of anemia i.e. hemoglobin concentration of less than 12 gm/dl among non-pregnant married women of reproductive age (MWRA) and potential risk factors of anemia among these MWRA with a special focus on coastal slum.

Methods

A analytical cross sectional study conducted at a coastal slum of Karachi, Rehri Goth. We interviewed N-554 non pregnant MWRA and their blood samples were assessed for anemia. Cox proportional hazard algorithm was used for determining the association of potential covariates with anemia for the analysis purpose.

Results

The prevalence of anemia among the non pregnant MWRA was 68.04% (95%CI: 64.15%, 71.92%). Prevalence ratio of anemia among gutka consumers was 1.37 times (95%CI: 1.12 - 1.68) higher than those who were not consuming it. Moreover, the prevalence ratio of anemia was 1.42 times higher in women who had not received formal education as compared to those who had received at least a primary education.(95% CI:1.13-1.81)

Conclusion

A high proportion of non pregnant MWRA of Rehri Goth were anemic. Women who were not literate were more likely to be anemic and were more likely to consume Gutka as a recreational substance.

Background

Anemia is a major public health hazard affecting millions in both the developed as well as the developing world. MWRA and children's are mostly affected in any stage of life, which mostly results in poor outcomes (1) The global estimates indicate that around 468.4 million (17%) non pregnant and 19% (16.2 million) of pregnant women between the ages of 18-49 years are anemic. (2) Sub Saharan African and South Asian regions are the most affected with high prevalence, of 47.5% and 35.7% respectively. (1,2) Similarly, the situation in the Eastern Mediterranean region is also alarming, which has the prevalence of around 32.4%. (1)

Hemoglobin concentration should be assessed to diagnose anemia, which is normal if the level of hemoglobin among non-pregnant MWRA is 12 gm/dl or above. (3) The common causes of anemia in women include: iron deficiency, heavy blood loss as a result of menstruation, parasite infestations, acute and chronic infections and illnesses that can lower hemoglobin like blood disorders, cancer, tuberculosis, and HIV; and risk of anemia increases in case of pregnancy and results in poor birth outcomes. (4-7) Around 20% of maternal deaths are due to maternal anemia, adding 115,000 deaths to the total maternal deaths related to obstetric complications per annum. (8) Pakistan is among the top 10 countries for maternal and neonatal mortality, at 140 per 100,000 and 42 per 1000 live births, respectively. (9-11) Further, prevalence of anemia among non pregnant MWRA is around 52% in Pakistan and in Sindh province it is even high i.e. 62%. (12)

Currently one in three urban residents live in slums. (13) By 2050, nearly 2.3 billion of the population globally in developing countries is expected to be absorbed by urban areas. (13-16) The situation is a result of: poor linkages with the quality health system, poor health infrastructure, and their access to health services, quality nutrition, education, hygiene and sanitation, clean drinking water, and other civic amenities being inadequate. (14-17) The poverty and lack of livelihoods in these coastal villages is leading to poor health, food insecurity, hunger, and consuming monotonous diets. (14) These stressors may lead to poor habits of substance abuse among the population, especially Gutka. (15-17)

A study in coastal slum of Kochi, Kerala, India revealed the prevalence of anemia to be around 72% among the non pregnant MWRA. (18) This may link with poor quality of diet and may be associated with poor absorption of nutrients, which may be due to high consumption of substance like Gutka, inappropriate dietary intake, food insecurity and other medical or sociodemographic factors. (20-26) (27-29) However, limited data is available on the prevalence of anemia among non pregnant women in these areas and related key factors. Considering high prevalence of anemia in limited available literature, especially from coastal slums of Karachi, we intend to study prevalence of anemia among non-pregnant married women of reproductive age residing in this area and to determine key predictors of anemia among non pregnant MWRA (18-49 years) residing in a peri-urban coastal slum of Karachi Pakistan.

Methods

Study design and study site

An 'analytical cross-sectional survey' was conducted to assess prevalence of anemia and to collect information of predictors of anemia at study site. Study was conducted in Rehri Goth, one of the oldest coastal slums located in Bin Qasim Town, Karachi. Total population of the area is around 42 thousand people. (27) Data from an NGO named VITAL Pakistan Trust suggest that area has high maternal and neonatal mortality; 300 per 100,000 live births and 57 per 1000 live births, respectively. (unpublished data) (30)

Sample population and Sampling Frame

The target population for this study were all MWRA (18-49 years). Around 12,000 married women of reproductive age are registered in the surveillance system. Our sampling frame was these 12,000 women. The basic line listing of registered women, maintained by local NGOs VPT in collaboration with Department of Pediatrics and Child Health, Aga Khan University (AKU), has been used to identify MWRA. This line listing is updated every two months and every married woman has been given a unique household identification number. The current system captures routine information on key vital events such as pregnancy, birth outcomes and deaths. For this study, women were randomly selected through computer generated simple random numbers.

Participant eligibility criteria

MWRA were approached and screened regarding eligibility for participation, the inclusion and exclusion criteria provided in Table 1. For eligible participants, written informed consent was obtained in the local language.

Sample Size

OpenEpi software was used to calculate the sample size. Unpublished data from the antenatal services of VITAL Pakistan Trust suggests that around 50% of population consume gutka including about 30% of pregnant women. We assumed that MWRA in this community will have prevalence of anemia close to prevalence in Sindh province which is 62%. (12) Based on understanding through unpublished clinical data from VITAL Pakistan, we learnt that pregnant women who consumed gutka, has around 12% higher chances of hemoglobin level less than 12 gm/dl. Therefore, for sample size calculation, 12% prevalence difference of anemia between the population exposed to gutka compared to unexposed. The sample size of at least 510 women was estimated to find the prevalence difference of 12% at p-value of significance < 0.05 , power of 80%. Further, adjusting for expected overall refusal rate of 8.4%, which is based on our experience of 4% refusal with consent procedures and 4.4% refusals with blood specimens during antenatal clinic and missing data after consent procedure. Therefore, the inflated in sample size for this survey was '557 non pregnant MWRA'.

Informed consent procedure

For the eligible participants, written informed consent was obtained by the research team in a local language (mostly Urdu and where required, in the languages Sindhi and Pashto). The team members explained the details of the survey, including the purpose, specimen collection, and other related processes. If a participant was eligible and agreed to undergo the procedure as explained, the research team gave the consent form to the participant or decision maker, or if they were unable to read it, a team member read it word-by-word for them in Urdu or the local language. The participants were allowed to ask any questions related to the consent form and trial procedure. If the participant/decision maker required additional time to make more informed decisions, the team also allowed this opportunity and waited until the final voluntary decision was made. If the participant voluntarily agreed to participate, the participant signed the consent form in the presence of a witness; either the form was duly signed, or a thumb

impression was provided by participant and the witness. The ethics committee approved the use of a thumb impression by the participant and witness if they were unable to read or write. A copy of informed consent was provided to all participants and attached in the file with the study ID.

Data collection procedure

Every household where any MWRA resides in the surveillance area of Rehri Goth was numbered with a unique ID. This line listing formed the sampling frame for the selection of the study sample i.e. sample of 554 households were randomly selected from this list. A community health worker with one senior research assistant reached the selected women for introduction of the study, eligibility, and consent. As the initial step, eligibility assessment was performed, and if found eligible, the women were explained about the research and written informed consent was taken. The interviews were conducted in local language followed by a collection of blood sample for testing for hemoglobin levels. Each interview lasted for approximately 30-40 minutes. All the Interviews and blood sample collection were carried out at the household with privacy.

The pilot study was conducted using the around 10% of the actual sample size ($n=50$), at the adjacent community of Ibrahim Haidri, a neighboring coastal village with identical socioeconomic status and cultural characteristics. The purpose of the pilot was to assess the feasibility and robustness of consent, tools, and study procedures. With the outcomes of the pilot phase, we refined our study tool. The actual data collection was conducted between April 10 to May 10, 2018.

Data collection tool

A screening questionnaire was used to identify the eligibility criteria of the selected woman from the random list, i.e. MWRA 18-49 group with no exclusion criteria. If the selected woman did not meet any of inclusion criteria and/or had any of the exclusion criteria, she was considered ineligible. A close-ended questionnaire, especially designed to capture the key information of interest, was used in the interview to collect data. Questionnaire was comprised of important demographic information related to characteristics of the women, screening for eligibility, household related information, reproductive history, socio-economic status, personal history such as Gutka consumption, food consumption and frequency using last four week recall, and standard variable used for food insecurity. We have also used standard questions of food insecurity adopted from the *Household Food Insecurity Access Scale for Measurement Food Access: Indicator Guide Version 3*. (31)

Specimen collection

All specimens which were collected on daily basis, were transported to Koohi Goth Hospital Laboratory, Research and Training Center, following the proper procedure of transportation using carrier. The blood test for hemoglobin was run on the same day of sample collection and reports were generated and delivered to the research team on the next day. The standard operating procedure for blood specimen

collection were adopted from 'WHO Guidelines on Drawing Blood: Best Practices in Phlebotomy'. (32) The report contained complete blood count indicators and a copy was provided to the family by the team.

Data Analysis

Data analysis was conducted using Stata version 12. Descriptive analysis was carried out for basic demographic covariates by generating frequencies and percentage. For inferential analysis, a single binary variable 'hemoglobin level 12 gm/dl or greater' was considered as normal and any value less than 12 gm/dl was defined as anemia. Unadjusted prevalence ratio was calculated using univariate cox proportional hazard analysis with 95% CI. All variables which were found to be significant at univariate analysis at p-value less than 0.25, were selected to be analyzed in the multivariate model by stepwise regression. Variables with p-value less than 0.05 were found to be statistically significant; prevalence ratios were recorded at each model building and reported as adjusted prevalence ratio.

The main exposure variables in the analysis were Gutka consumption, women's education, seafood consumption, consumption of iron rich diet, type of toilet which the woman uses, regular fecal disposal at household level, parity, gravidity, total number of children under five years of age, and other socioeconomic indicators. Further, using international analysis guideline of Household Food Insecurity Access Scale (HFIAS) for Measurement Food Access: indicator Guide Version 3, the food security condition of each household was calculated. (31) The HFIAS module yields information on food insecurity (access) at the household level. Four types of indicators were calculated to understand characteristics of and changes in household food insecurity (access) among the participants. The responses from the household food insecurity (access) were entered into an excel sheet and tabulation was done for these indicators and status of household food insecurity was finally measured i.e. whether the woman is residing in food secure or insecure household. The data was then incorporated with main dataset for analysis.

Quality assurance and data management

All filled questionnaires were passed through an astringent quality control mechanism, such as the questionnaire was filled again through a senior research staff to see difference between two of them and 100% quality checking was performed by senior research staff. Discrepancies were solved by revisiting the household, as and when required. Further, 20% of the data collected was rechecked at the field by PI by household visit on the next day to check the data validity.

Results

Total 613 non pregnant MWRA (18-49 years) were approached from the random list to achieve the sample size of 557. Out of 613, 13 (2.1%) refused for eligibility assessment and 600 MWRAs were screened for eligibility. Non-pregnant MWRA with inclusion and no exclusion were 589, out of which 32 (5.4%) refused to give consent. Total MWRA consented and enrolled in the survey were 557. Figure 1 is showing the study flow. The mean age of the women was 31.3 years (SD 7.9). Women with age equal

and greater than 36 years, had higher prevalence of anemia of 73.15% than others. The other age categories i.e. younger than 25 years and 25-35 had an anemic prevalence of 67.47% and 64.15% respectively. The mean hemoglobin level was 11.2 gm/dl (SD 1.6) and overall prevalence of the anemia in the sample was calculated to be 68.04% (95 % CI: 64.15 – 71.92). Table 2 is representing anemia prevalence among the sample population.

Gutka consumption was common; 38.24% of the women used it regularly at an average intake of 2.8 times per day. Among these women, the prevalence of anemia was 83.57%. In the 61.75% of the sample who did not consume Gutka, the prevalence of anemia was lower at 58.43%. Additional analysis of the data revealed that only 32% of the participants mentioned that they have at least primary education or more. Among these participants, the prevalence of anemia was 53.07%. However, women with no formal education suffer a much higher prevalence i.e. 75.13%. Only 7% of participants were found to be engaged in some kind of employment, and among them 62.50% were anemic. Prevalence of anemia also had some correlation with the wealth quantiles of the participants. 20.10% of these MWRA belonging to the poorest wealth quantile had an anemia prevalence of 71.43%. The prevalence of anemia among the rest of the wealth quantiles which were poor (19.92%), middle (20.10%), rich (19.92%) and richest (19.92%) households was 70.27%, 63.39%, 68.47%, and 66.67% respectively.

Approximately 59.42% of the households where these MWRA reside were food insecure (mild to severe) and prevalence of anemia among these food insecure households was 68.28%. Seafood intake was high among the participants; 77.01% of the participants consumed seafood (fish and/or prawns) at least once a month. The prevalence of anemia among participants was 68.99%. Those who did not eat seafood at all had a slightly lower prevalence of anemia at 64.84%. Furthermore, about 50.80% of participants only consumed seafood. With no other source of meat (red meat or poultry), 73.85% of them were anemic, compared to 62.04% prevalence in participants who consume all types of meat in a month. A very large number of women i.e. 65.70% mentioned that they did not consume red meat at all and the prevalence of anemia among them was found to be 72.95%. In comparison, 34.29% of participants who consumed meat at least once in a month had a 58.63% prevalence of anemia. Table 3 presents the descriptive and prevalence.

Further analysis using cox proportion revealed Gutka and education status of non-pregnant MWRA as significant predictors of anemia among the study participants. The adjusted prevalence ratio of anemia among those women who consume Gutka was 1.37 times more, as compared to the women who did not consume Gutka at all (95 % CI: 1.12 – 1.68). Additionally, the adjusted prevalence of anemia among women who had no formal education was 1.42 times higher in comparison to those who had at least primary education (95 % CI: 1.13 – 1.81). The rest of the variables which were found significant at univariate analysis became insignificant at multivariate analysis in the model.

Discussion

The prevalence of anemia in non-pregnant MWRA in Rehri Goth was found to be 68.04%. The estimated prevalence is greater than the overall prevalence of Sindh province in Pakistan. (12) A study from Indian coastal belt identified that around 89% of the MWRA were anemic. (33) This indicates that health status of MWRA in the costal slums is at dismal. (14) The high prevalence in married women may be associated with many factors, which may be associated with household characteristics. (34) Maternal education also plays a pivotal role in improving the health status of women. (35, 36) An educated woman from low income settings can take better and informed decision for her health related issues, (35, 36) which is something that is lacking in Rehri Goth. Awareness about good nutrition and knowledge about health risks of other poor behaviors are improved if women are educated. (37) This may reduce the chances of anemia among these women. (37) In this study, it is found that anemia prevalence is high among MWRA with no formal education and most of them did not have formal education.

Linking low education status to poor behaviors which are prevalent in these coastal slums is crucial; the use of gutka being one of the emerging health risks. (38) South Asians have the highest prevalence of gutka consumption with increasing trends among women, (39) ignoring the health risk associated with the use of it. (40) The use of gutka among MWRA in slums is strongly associated with wealth, knowledge, and education status. (41) This study suggests that use of gutka in Rehri goth is strong predictor of anemia.

This study did not find any significant association of anemia with other factors, but other studies have shown significant correlation of anemia with food insecurity, gravidity, birth interval, use of contraception and wealth quantiles. (26, 42) However, this study successfully highlighted the magnitude of maternal anemia, which is also very high in this coastal slum. Further, we used pre-validated variables in the questionnaire to maintain rigor of the study, including food frequency questionnaire, variables for measuring household food insecurity, wealth quauntiles, and other potential associated factors. This assured the validity and generalizability of the study.

One of the study limitation was that a cross-sectional study was used to investigate the prevalence and risk factors of anemia among non pregnant women in urban slum; such a study design does not give clear indication of the sequence of events hence, we cannot draw causal inferences from the findings. As most of the responses were based on maternal recall, there may be chance of recall bias in the study. To counter these problems, research team was specifically trained in probing against each variable.

Conclusion And Recommendations

Anemia is one of the major public health concerns for health care providers and also for policy makers in low and middle-income countries. This study has determined the association between Gutka consumption and anemia. To gain a better understanding and insight into important determinants of anemia, the community and individual level factors must be studied. Hence, awareness and proper family planning guidance programs must be proposed regarding the health benefits of small family size in such urban slum areas of Pakistan. Additionally, education of women is necessary to take care of their health

and its important in nurturing of the family. If a woman is educated, she is less likely to follow the poor lifestyle and negative health behaviors like Gutka consumption. We strongly recommend raising awareness about a balanced diet and ill-health effects of Gutka in these communities. At the policy level, such poor communities should be provided with safety nets for better nutrition to prevent malnutrition, not only in the current generation but also in future generations.

Abbreviations

HFIAS	Household Food Insecurity Access Scale
MWRA	Married women of reproduction age

Declarations

Competing interests

The authors declare that they have no competing interests.

Funding

This study was not funded by any external sponser. However, author received support by VITAL Pakistan Trust through existing maternal, neonatal and child health program to conduct laboratory assessment.

Ethics and consent to participate

Ethical approval has been taken from ‘Ethical Review Committee’ at Aga Khan University (Refrence number: 5090-CHS-ERC-17). Written informed consent was administered in a local language to eligible participants and explained about the research. In cases where the MWRA was not educated, consent was documented by a thumbprint in the presence of literate witness.

Availability of the data and material

Deidentified dataset are available from the corresponding author on reasonable request.

Consent publication

Not applicable

Authors’ contribution

AM: conceived the idea and study, developed protocol, tools standard operating procedures and performed the analysis. YS, SS, IN, and SIA: contributed to the design of the study and developed the study protocol and standard operating procedures. AM, DAC, and ET: drafted the manuscript. AM:

implemented and supervised the study. AM, IN, SIA, SS and SST: coordinated the activities and contributed to the manuscript. All authors provided feedback and approved the final manuscript.

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Tables

Table 1 | Inclusion and exclusion criteria

Inclusion criteria	Exclusion criteria
<ul style="list-style-type: none">· Married women of eligible age criteria who were not pregnant or had delivered at least 6 months back from the day of data collection· Women who were permanent resident of Rehri Goth since last one year at least.· Women who gave a written consent to participate in the study and for specimen collection.	<ul style="list-style-type: none">· Any known diagnosed case of blood disorder

Table 2 | Prevalance of anemia among non pregnant MWRA

Category of anemia	Prevalence (95% CI)
Overall Anemia	68.04% (64.15 , 71.92)
Mild Anemia	33.21% (29.29 , 37.13)
Moderate Anemia	30.34% (26.51 , 34.17)
Severe Anemia	4.49% (2.76 , 6.21)

Table 3 | Descriptives and prevalence ratios

Variables	N (Prevalence of anemia-%)	Crude prevalence ratio (95%CI)	Adjusted prevalence Ratio (95%CI)
Age of women in completed years			
Less than equal to 25 years	159 (64.15)	Ref	
26 – 35 years	249 (67.47)	1.05 (0.82 - 1.34)	
36 years and above	149 (73.15)	1.14 (0.87 - 1.49)	
Gravidity			
Less than 2	207 (61.84)		
2 or more	350 (71.71)	1.15 (0.93 - 1.43)	
Parity			
Less than 2	246 (62.60)		
2 or more	311 (72.35)	1.15 (0.94 - 1.41)	
Number of children currently alive			
Less than 2	264 (62.50)		
2 or more	293 (73.04)	1.16 (0.13 - 0.95)	
Number of children under the age of 5 years			
None	247 (68.02)		
At least one	310 (68.06)	1.00 (0.87 - 1.22)	
Number of children under the age of 2 years			
None	348 (66.95)		
At least one	209 (69.86)	1.04 (0.84 - 1.28)	
Women Education			
No formal education	378 (75.13)	1.41 (1.12 - 1.78)	1.42 (1.13 - 1.81)
At least primary education	179 (53.07)		
Gutka Consumption			
Consume gutka	213 (83.57)	1.37 (1.12 - 1.68)	1.37 (1.12 - 1.69)
Do not consume	344 (58.43)		
Occupation of women			
Unemployed	517 (68.47)	1.09 (0.73 - 1.63)	

Employed	40 (62.50)	
Ethnicity		
Sindhi	343 (67.06)	0.98 (0.78 - 1.24)
Urdu speaking	44 (59.09)	0.89 (0.58 - 1.37)
Others	170 (72.35)	
Family structure		
Nuclear	337 (69.44)	
Joint	220 (65.91)	0.94 (0.77 - 1.16)
Husband's occupation		
Unemployed	40 (62.50)	0.99 (0.80 - 1.23)
Fisherman	212 (68.4)	0.91 (0.60 - 1.38)
Other type employment	305 (68.52)	
Toilet facility at the household		
Traditional pit or open field	114 (80.7)	1.24 (0.98 - 1.57)
Flush toilet	443 (64.79)	
Regular fecal disposal is present at household toilet facility		
Yes	485 (65.77)	1.26 (0.96 - 1.66)
No	72 (83.33)	
Wearing shoes before using the toilet		
No	50 (86.00)	1.29 (0.94 - 1.78)
Yes	507 (66.27)	
Washing Hands after using toilet		
Occasionally with soap	120 (67.5)	0.98 (0.77 - 1.26)
Always with soap and water	437 (68.19)	
Household food security		
Food insecure	331 (68.28)	1.00 (0.82 - 1.23)
Food secure	226 (67.70)	
Wealth Quintile		

Poorest	112 (71.43)	1.07 (0.78 - 1.46)
Poor	111 (70.27)	1.02 (0.76 - 1.44)
Middle	112 (63.39)	0.15 (0.68 - 1.31)
Rich	111 (68.47)	1.16 (0.74 - 1.41)
Richest	111 (66.67)	
Sea food consumption		
At least one time per week per day	148 (72.97)	1.21 (0.91 - 1.83)
1 to 2 times per month	281 (66.9)	0.91 (0.69 - 1.19)
Do not eat at all	128 (64.84)	
Red meat consumption		
Do not eat at all	366 (72.95)	1.29 (0.91 - 1.83)
1 to 2 times per month	127 (59.84)	1.06 (0.71 - 1.58)
At least one time per day per week	64 (56.25)	
Only Sea Food and no other meat source		
Yes	283 (73.85)	1.19 (0.97 - 1.45)
No	274 (62.04)	Ref
Dairy product consumption		
Do not eat at all	143 (67.13)	0.9 (0.64 - 1.28)
1 to 2 times per month	349 (67.34)	0.91 (0.66 1.24)
At least one time per day per week	65 (73.85)	
Poultry consumption		
Do not eat at all	53 (66.04)	0.92 (0.63 - 1.34)
1 to 2 times per month	322 (66.46)	0.93 (0.74 - 1.15)
At least one time per day per week	182 (71.43)	
Legume consumption		
Do not eat at all	277 (70.04)	1.02 (0.84 - 1.25)
At least one time per week per day	280 (66.07)	

Iron rich vegetables		
Do not eat at all	65 (73.85)	1.15 (0.82 - 1.61)
1 to 2 times per month	307 (69.38)	1.08 (0.86 - 1.36)
At least one time per week per day	185 (63.78)	
Grains consumption		
1 to 2 times per month	17 (76.47)	1.12 (0.64 - 1.96)
At least one time per week per day	540 (67.78)	
Dry Fruits		
Do not eat at all	468 (67.95)	0.87 (0.53 - 1.43)
1 to 2 times per month	67 (65.67)	0.84 (0.48 - 1.48)
At least one time per week per day	22 (77.27)	
Iron Rich Fruits		
Do not eat at all	468 (69.23)	1.01 (0.60 - 1.70)
1 to 2 times per month	67 (59.7)	0.87 (0.48 - 1.58)
At least one time per week per day	22 (68.18)	
Modern Contraceptive use		
Any modern contraceptive use	202 (65.84)	0.95 (0.76 - 1.17)
No method all	355 (69.30)	
Worm infestation		
Yes	43 (72.09)	1.06 (0.73 - 1.53)
No	514 (67.7)	

Figures

Figure 1

Study flow

Supplementary Files

This is a list of supplementary files associated with this preprint. Click to download.

- [STROBEchecklistcrosssectional1.doc](#)