A cross sectional study on the motivators for Asian women to attend opportunistic mammography screening in a private hospital in Malaysia: the MyMammo study

Norhashimah Hassan1,2, Weang Kee Ho3, Shivaani Mariapun1,2 and Soo Hwang Teo1,2*

Abstract

Background: To date, because of limited budgets and lower incidence of breast cancer, the majority of Asian countries do not have population-based screening programmes, but instead offer opportunistic screening. However, there have been few studies which have assessed the motivators for women attending such programmes and the appropriateness of the programmes in terms of targeting women at risk.

Methods: We conducted a prospective cross-sectional study of 1,619 women aged 40 to 74 years attending a subsidized opportunistic screening mammogram from October 2011 to October 2013 at a private hospital in Malaysia. Breast cancer risk was estimated using the Gail Model and two-step cluster analysis was used to examine the motivators of attending screening.

Results: Although Malaysia comprises 54.5 % Malay, 24.5 % Chinese and 7.3 % Indian, the majority of women in the MyMammo Study were Chinese (70.1 %) and 99.2 % had a <2 % ten-year risk of breast cancer. The most commonly cited barriers were the perception of not being at risk and fear of painful mammography. We found that highly educated women, cited doctors, family and friends as their main motivators. Of those with only secondary school education, their main motivators were doctors.

Conclusions: Taken together, our results suggest the women attending opportunistic mammography screening in Asia are at low risk of breast cancer and this poses challenges to cost-effective and equitable strategies for cancer control. We propose that to improve uptake of screening mammography, awareness programmes should target both doctors and members of the public.

Keywords: Mammography, Screening, Breast Cancer, Malaysia, Asia

Background
Breast cancer is the most common cancer in women and accounts for ~12.7 % of all cancer deaths in Asian women [1]. Although breast cancer incidence is lower in Asia compared to that in Western countries, it is now rising rapidly in Asian countries because of longer life expectancy and dramatic changes in parity and lifestyle [1–4]. The increasing burden of breast cancer in Asian countries is exacerbated by late presentation and limited access to therapies, resulting in poorer outcomes [5–7].

In high-income Asian countries with higher breast cancer incidence, such as Singapore, Korea and Japan, organized national mammographic screening is available, but uptake varies from 20 to 57 % [8–12]. In the other Asian countries, only opportunistic screening is available [13] and uptake is generally low, ranging from <1 % in Thailand [14], to ~7 % among rural Malaysian women [15–17]. A number of reasons for poor uptake have been described in Singapore, Thailand, Malaysia and Iran, and
these include cost of screening, lack of time, distance to screening facilities and fear of cancer [14, 18–20].

Faced with limited budgets and an increasing incidence of breast cancer, the governments of Asian countries are facing difficult decisions on how to offer screening equitably and cost-effectively, and in particular, how to target limited resources to women at higher risk of developing breast cancer. However, there is paucity of data on the risk profile of Asian women attending opportunistic screening and limited data on how to motivate women to come forward for screening. In this study, we sought to describe the risk profile of women attending opportunistic screening at a private hospital in Malaysia, to examine the barriers and motivators of women attending screening, and to explore whether there are subgroups of healthy women with similar self-reported motivators for attending screening in Malaysia. Findings from these analyses may inform the utility of opportunistic mammography screening and further, the functional clustering may provide insight into how screening messages should be framed for more effective promotion of screening mammography in the future.

Methods
Study description
The Malaysian Mammography Study [MyMammo] is a subsidized opportunistic mammogram screening programme in a private tertiary hospital located in a suburban area in Malaysia. Screening was offered to women who did not have a personal history of breast cancer and who have not had a mammogram for at least one year prior to participating in the programme. Participants were recruited using flyers and posters at the hospital, and articles in the mainstream English, Chinese and Malay media. From October 2011 to October 2013, 1,619 women were enrolled into the study. Participants had a digital mammogram, donated a blood sample for research and completed a questionnaire of information in relation to demographic characteristics, anthropometric factors, menstrual and reproductive history, family history of cancer and, motivators and barriers for participating in the MyMammo study. Women were excluded if they were younger than 40 years old (n = 6), older than 74 years old (n = 4), previously diagnosed with other cancer (n = 23) or having a first degree relative included affected mothers and sisters. Overall, the mean age was 50 years old, the majority of participants were Chinese (70.1 %), >90 % had secondary or tertiary education and 19 % were considered high income. The mean age of menarche was 13 years old and 84 % of women were parous, with a mean age of first live birth of 28 years old. Whilst 30 % of women had ever used oral contraceptives, less than 10 % had used hormone replacement therapy. Only 10 % of women report a family history of breast cancer and 9 % had previously had a breast biopsy. Twenty one percent of patients had previously had gynaecological surgery. Overall, the mean ten-year risk for women aged 40-79 was 0.77 %, ranging from 0.4 % to 14.4 %. The majority of women (n = 1453, 99.2 %) were estimated to have a <2 % risk of breast cancer, with only 0.8 % (n = 19) at 2 % risk (Fig. 1).

Results
Study cohort
The MyMammo study is an opportunistic mammography screening programme established at a private hospital in the suburban area of Subang Jaya in Malaysia. The mean age was 50 years old, the majority of participants were Chinese (70.1 %), >90 % had secondary or tertiary education and 19 % were considered high income. The mean age of menarche was 13 years old and 84 % of women were parous, with a mean age of first live birth of 28 years old. Whilst 30 % of women had ever used oral contraceptives, less than 10 % had used hormone replacement therapy. Only 10 % of women report a family history of breast cancer and 9 % had previously had a breast biopsy. Twenty one percent of patients had previously had gynaecological surgery. Overall, the mean ten-year risk for women aged 40-79 was 0.77 %, ranging from 0.4 % to 14.4 %. The majority of women (n = 1453, 99.2 %) were estimated to have a <2 % risk of breast cancer, with only 0.8 % (n = 19) at 2 % risk (Fig. 1).
Women with previous mammogram were older ($p < 0.001$), tend to have higher socio-economic status (income $p = 0.01$, educational level $p = 0.006$), more likely to be menopausal ($p < 0.001$), have first live birth at an older age ($p = 0.001$), and more likely to have had hormone replacement therapy ($p < 0.001$) compared to women without previous mammogram. They also have higher proportion of positive family history of breast cancer ($p < 0.001$) and diabetic ($p = 0.05$). The remaining variables, namely ethnicity, age at menarche, smoking status and previous breast or gynaecological surgery, did not differ significantly between the two groups (Table 1).

For 709 women (48.8 %) that cited the MyMammo Study as their first breast screening mammogram, 30 % (209) cited perception that they are not at risk, 20 % (139) cited fear of painful mammography, and 10 % (68) cited cost, as barriers of attending opportunistic screening.

**Cluster analysis**

Whilst the association analyses revealed the differences between women who have previously attended mammogram compared with those who had not, it did not reveal whether there were subgroups of healthy women with similar self-reported motivators for attending opportunistic screening in Malaysia. To do this, we conducted a cluster analysis to determine the characteristics of women presenting for opportunistic screening, starting first with a model containing all variables in Table 1, mammography history, age at first mammogram and motivators for attending screening, and sequentially excluding variables with the least association with mammography history (Table 2). We observed that the full model and Model two generated more than three clusters with poor separation. Models 1, 3, 4 and 6, and Models 5, 7 and 8 generated two and three clusters, respectively, with fair cluster quality and similar profiles. However, only the three-cluster models show a significant difference between motivators. Although there is a slight increase in BIC value after dropping parity and menopausal status from the analysis (comparing Model 5 with Model 8), the most parsimonious model was Model 8, as it contained the least variables and all variables in the model remained significantly different between the three clusters (Table 3).

The first and largest cluster ($N = 451$) comprised older women (mean age 52 years), all of whom have had a mammogram previously (mean age of first mammogram 44 years). Notably, women in cluster 1 had the most significant family history of breast cancer (13.1 %) and the motivators for participating in opportunistic screening were varied (family and friends, doctors, themselves and public campaign).

Cluster 2 is the smallest group ($N = 262$) and consists of younger participants (mean age 45 years), the majority of whom have never had a mammogram (98.5 %). They are the most highly educated (75 % have attended college or university) and have the highest monthly income (38 % earned above RM10,000 per month). Women of this cluster had the smallest proportion of overweight (35.9 %) or diabetic women (2.7 %) and the lowest use of hormone replacement therapy (2.7 %). These women were motivated to attend opportunistic screening by their doctors, family or friends.

Cluster 3 ($N = 276$) consists of older women (mean age 51 years), the majority of whom have never had a mammogram previously (93.8 %). Women in this cluster had the lowest socio-economic status: 98.9 % were educated at
| Variable | All women N = 1453 | Previous mammogram N = 744 | First mammogram N = 709 | P value |
|----------|------------------|------------------|------------------|---------|
|          | N | % | N | % | N | % |
| **Demographics** | | | | | | |
| Age $^{1a}$[mean, sd] | 50.0 | 7.0 | 53.0 | 7.0 | 48.0 | 7.0 | <0.001 |
| Ethnicity$^{2a}$ | | | | | | |
| Chinese | 1018 | 70.1 | 530 | 71.2 | 488 | 68.8 | 0.194 |
| Indian | 223 | 15.4 | 117 | 15.7 | 106 | | |
| Malay | 160 | 69.0 | 9 | 9.3 | 91 | 12.8 | |
| Others | 52 | 3.5 | 28 | 3.8 | 24 | 3.4 | |
| Education Level$^{2}$ | | | | | | |
| Primary | 90 | 6.2 | 34 | 4.6 | 56 | 8.1 | 0.006 |
| Secondary | 728 | 50.1 | 366 | 49.9 | 362 | 52.3 | |
| Tertiary | 608 | 41.8 | 334 | 45.5 | 274 | 39.6 | |
| Missing | 27 | | 10 | | 17 | | |
| Monthly Income (RM)$^{2}$ | | | | | | |
| Below 5 k | 689 | 47.4 | 325 | 44.1 | 364 | 52.1 | 0.010 |
| 5 k to 10 k | 470 | 32.4 | 260 | 35.3 | 210 | | |
| Above 10 k | 277 | 19.1 | 152 | 20.6 | 125 | 17.9 | |
| Missing | 20 | | 10 | | 10 | | |
| **Hormonal** | | | | | | |
| Endogenous | | | | | | |
| Age at menarche$^{1a}$[mean, sd] | 13.0 | 1.0 | 13.0 | 1.0 | 13.0 | 1.0 | 0.626 |
| Missing | 10 | | 5 | | 5 | | |
| Menopausal status$^{2}$ | | | | | | |
| Pre/perimenopausal | 783 | 53.9 | 299 | 40.2 | 484 | 68.6 | <0.001 |
| Post-menopausal | 667 | 45.9 | 445 | 59.8 | 222 | 31.4 | |
| Missing | 3 | | 0 | | 3 | | |
| Parity$^{2}$ | | | | | | |
| Nulliparous | 229 | 15.8 | 104 | 125 | 17.6 | 0.057 |
| Parous | 1224 | 84.2 | 640 | 82.4 | | | |
| Age at first live births$^{1a}$[mean, sd] | 28.0 | 5.0 | 28.0 | 5.0 | 27.0 | 5.0 | 0.001 |
| Missing | 230 | | 105 | | 125 | | |
| Exogenous | | | | | | |
| Oral contraceptive usage status$^{2}$ | | | | | | |
| Never | 1004 | 69.1 | 508 | 68.5 | 496 | 70.4 | 0.435 |
| Ever used | 443 | 30.5 | 234 | 31.5 | 209 | 29.6 | |
| Missing | 6 | | 2 | | 4 | | |
| Hormone replacement therapy (HRT) status$^{2}$ | | | | | | |
| Never | 1306 | 89.9 | 627 | 84.6 | 679 | | <0.001 |
| Ever used | 142 | 9.8 | 114 | 15.4 | 28 | | |
| Missing | 5 | | 3 | | 2 | | |
Table 1  Malaysian Mammographic Study cohort description by mammography history (Continued)

Medical history

| Family history of breast cancer | No | Yes | Missing |
|--------------------------------|----|-----|---------|
| No                             | 1301 | 152 | 12 |
| Yes                            | 89.5 | 10.5 | 5 |
| Previous breast biopsy status  | No | 1305 | 136 | 12 |
| No                             | 89.8 | 9.4 | 5 |
| Yes                            | 676 | 63 | 7 |
| Missing                        | 91.5 | 8.5 | 7 |

Gynaecological surgery

| No | Yes | Missing |
|----|-----|---------|
| 1143 | 78.7 | 578 | 79.7 | 565 | 79.7 |
| 812 | 55.9 | 425 | 57.1 | 387 |
| 576 | 39.6 | 292 | 284 | 40.0 |
| 17 | 11 | 6 |

Body Mass Index (BMI)

| No | Yes | Missing |
|----|-----|---------|
| 48 | 3.3 | 16 | 32 | 4.5 | 0.030 |
| 812 | 55.9 | 425 | 57.1 | 387 |
| 576 | 39.6 | 292 | 284 | 40.0 |
| 17 | 11 | 6 |

Diabetes status

| No | Yes | Missing |
|----|-----|---------|
| 1335 | 91.9 | 673 | 91.1 | 662 | 93.8 |
| 110 | 7.6 | 66 | 8.9 | 44 | 6.2 |
| 8 | 5 | 3 |

Smoking status

| No | Yes | Missing |
|----|-----|---------|
| 1312 | 90.3 | 671 | 90.2 | 641 | 90.4 |
| 141 | 9.7 | 73 | 9.8 | 68 | 9.6 |

aIndicates variables in the Gail Model
1Indicates continuous variable
2Indicates categorical variable
T-test was used for continuous variables and chi-square test for categorical variables

Table 2 Summary for two-step cluster analysis

| Model | Exclusion | Number of Clusters | Schwarz's Bayesian Criterion (BIC) | Cluster quality |
|-------|-----------|--------------------|-----------------------------------|----------------|
| Full model | None | 4 | 18827.990 | Poor |
| Model 1 | Exclude smoking status | 2 | 18959.512 | Fair |
| Model 2 | Exclude age at menarche | 5 | 16456.869 | Poor |
| Model 3 | Exclude oral contraceptive status | 2 | 16212.759 | Fair |
| Model 4 | Exclude Gynaecology surgery status | 2 | 15089.163 | Fair |
| Model 5 | Exclude ethnicity | 3 | 12973.058 | Fair |
| Model 6 | Exclude parity status | 2 | 13416.631 | Fair |
| Model 7 | Exclude menopausal status include parity | 3 | 13372.869 | Fair |
| Model 8 | Exclude menopausal status | 3 | 13453.375 | Fair |

*Full model consists of all variables in Table 1, mammography history, age at first screening and motivators for attending screening. Model 1 – Model 8: sequentially excluding variables with least association with mammography history.
primary or secondary level, and 85.5% reported a monthly income of lower than RM5,000. Women from this cluster had their first live birth at the youngest age (25 years), had the least significant family history of breast cancer, and the largest proportion of diabetic (14.9%) and overweight women (52.2%). Significantly, amongst these older women from a lower socio-economic group, the majority were motivated by their doctors to attend opportunistic screening.
Although ethnicity was excluded from cluster analysis, further examination indicated that cluster 1 had the highest proportion among Indian women (70 out of 223, 31 %) and cluster 2 the highest among Malay women (76 out of 160, 44 %).

Discussion

The incidence of breast cancer is rising in most parts of Asia and Asian governments, particularly those from low and middle-income countries, face significant challenges in providing cost-effective and equitable screening for breast cancer. To date, the majority of low and middle-income Asian countries only offer opportunistic screening and the aspiration is that through health education and community health programmes, awareness and uptake of screening can help to ensure earlier presentation. In this study, we show that the majority of women attending opportunistic screening have an estimated <2 % risk of breast cancer in the next ten years, a threshold which is often considered where the benefits of screening outweigh the potential harms of over-diagnosis. This suggests that opportunistic screening in a private hospital in Malaysia does not target the women at high risk of breast cancer.

Previous studies using logistic regression have demonstrated a number of variables are associated with participation in mammography screening, but these studies provide limited information on how to target different groups of women [17, 18, 22]. In our study, we applied a different analytical method and suggest that functional clustering has provided insight into how screening messages should be framed for more effective promotion of mammography screening in the future. First, women with a higher risk of breast cancer on the basis of family history of breast cancer were more likely to attend screening at a younger age and they were motivated to participate in screening by various avenues. This suggests that health education focusing on the familial risk of breast cancer could be a strong motivator for Asian women to participate in screening but this approach has not hitherto been explored. Second, highly educated women could be motivated through a number of avenues including by their doctors, by family and friends or by public campaigns. Third, women in lower socio-economic classes were more likely to be motivated by their doctors to participate in screening. Taken together, this suggests that whilst highly educated women were accessible through public campaigns, women in lower socio-economic classes may not respond similarly to such campaigns. This is consistent with a systematic review of interventions to increase uptake of screening mammography among Asian women which suggests that media campaigns alone may be ineffective in increasing screening uptake [9]. In addition, our data suggests that doctors remain a significant avenue for educating women in lower socio-economic groups about screening and health education should specifically encourage primary care physicians to educate their clients about the potential benefits of screening. This is consistent with studies in Indian, Pakistani and Bangladeshi women in the UK where cultural awareness training for healthcare workers was found to increase mammography uptake [23].

The strength of the MyMammo study is the relatively large sample size and availability of data on breast cancer risk factors, which in turns enable the determination of the estimated risk of breast cancer. To date, reports on barriers and motivators among developing Asian countries have been limited to small cohorts, with limited information about breast cancer risk factors. However, the MyMammo study has a number of limitations. First, the study is conducted in a private hospital and study participants were asked to contribute a blood sample for research to determine genetic determinants of mammographic density. It is unknown whether these would have affected participation levels and the profiles of participating women. Second, as this is an opportunistic screening program, findings from this study cannot be extrapolated to the general population as it only represents a subset of women that came forward for screening.

Conclusions

The MyMammo Study has shown that the avenues for women to become aware of and be motivated to participate in opportunistic screening is different in high-income and low socio-economic women. Findings from this study may have implications on the approach of future health education and community awareness programmes in Malaysia and other Asian countries.

Competing interests

The author(s) declare that they have no competing interests.

Authors’ contributions

NH and WH carried out the statistical analysis and drafted the manuscript. SM recruited the patients and contributed to the design and coordination of the study. ST conceived the study, contributed to the design and coordination and drafted the manuscript. All authors read and approved the final manuscript.

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Author details

1Cancer Research Initiatives Foundation, Sime Darby Medical Centre, 1 Jalan SS12/1A, Subang Jaya 47500, Selangor, Malaysia. 2Breast Cancer Research Unit, University Malaya Cancer Research Institute, Faculty of Medicine, University Malaya Medical Centre, University Malaya, 50603 Kuala Lumpur, Malaysia. 3Department of Applied Mathematics, Faculty of Engineering, University of Nottingham Malaysia Campus, Jalan Broga, 43500 Semenyih, Selangor, Malaysia.
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