

Multi-disease Health Screening in an Urban Low-income Setting: A Community-based Study

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Abstract

Introduction: We were interested to determine the participation rates for health screening in a multi-ethnic urban low-income community. We assessed the health screening rates at baseline, collected data on reasons for non-participation and assessed the impact that a 5-month intervention had on health screening in this community. **Materials and Methods:** The study population involved all residents aged ≥ 40 years, living in heavily subsidised public rental flats in Taman Jurong Constituency, Singapore. From January 2009 to May 2009, we collected baseline information and offered eligible residents free blood pressure, fasting blood glucose and lipid measurements, fecal occult blood testing and Pap smears. Screenings were conducted either at or near the residents' homes. **Results:** The participation rate was 60.9% (213/350). At baseline, 18.9% (24/127), 26.4% (42/159) and 18.7% (31/166) had gone for regular hypertension, diabetes and hyperlipidaemia screening, respectively; 3.8% (6/157) and 2.9% (2/70) had had regular colorectal and cervical cancer screening, respectively. Post-intervention, rates for hypertension screening increased to 97.6% but increases for other modalities were marginal. High cost, lack of time, not at risk, too old, or unnecessary for healthy people were commonly-cited reasons for skipping regular health screening. Being unemployed was associated with missing regular hypertension screening (adjusted OR = 2.48, CI = 1.12-5.53, $P = 0.026$); those who did not need financial aid were less likely to miss regular hyperlipidaemia screening (adjusted OR = 0.27, CI = 0.10-0.72, $P = 0.008$). **Conclusion:** The participation rates for health screening were poor in this low-income community. More can be done to encourage regular health screening participation amongst this segment of the populace, both by reducing costs as well as addressing misperceptions.

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Introduction

With the burden of chronic disease rising amongst rapidly urbanising Asian populations, active participation in health screening would allow for early detection and management of disease. However, participation in health screening can vary greatly within populations and is influenced significantly by sociodemographic and attitudinal factors. In particular, socioeconomic status is a key factor influencing the participation rates of health screening. With rising income disparity in urbanising Asian societies, it is of concern that not all segments of society might have equal access to and participation in health screening, a key facet of preventive medicine.

In urban Singapore, utilisation of health screening is high amongst the general population. In the Ministry of Health's National Health Surveillance Survey 2007, 63.9%, 72.2%, and 78.0% of the general population aged 40 to 69 years had regularly gone for their blood pressure, fasting blood glucose and fasting blood lipid tests, respectively.¹ Screening for hypertension, diabetes and hyperlipidaemia, together with various cancers like cervical, breast and colorectal cancer, is thus well-accepted amongst the general populace. However, the participation rates of these screening modalities amongst the lower-income segment of the populace are largely unknown. As the burden of chronic disease is disproportionately higher in those of

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lower socioeconomic status,²⁻⁴ it is of interest to determine whether this segment of the Singaporean population has adequate access to health screening for chronic disease. While organised population screening programmes may be successful in increasing overall participation rates, they may not substantially reduce social inequalities.⁵ If disparities in utilisation of health screening do exist in Singapore, then we were also interested in seeing whether facilitatory interventions, including cost reduction, could raise participation amongst this segment of the population.

In order to increase participation of health screening amongst the lower-income segment of the populace, the National University of Singapore's Medical Students' Society has been organising the Neighbourhood Health Screening (NHS) since 2009. Essentially, the Neighbourhood Health Screening brings subsidised health screenings in 5 major diseases (hypertension, diabetes, hyperlipidaemia, cervical cancer, colorectal cancer) to the doorstep of needy residents in the constituency of Taman Jurong, in the western part of Singapore. The residents served by this programme fall into the lower socioeconomic strata in Singapore; they live in one to two room rental flats and have a household income of less than \$1500 a month. We hoped to overcome some of the barriers to health screening participation in this population by providing subsidised health screenings in close proximity to the residents' homes. We analysed the health screening participation rates both pre- and post-intervention, in the 5 major chronic diseases previously mentioned; as well as the barriers to health screening that were encountered, in order to gain insight into the challenges faced by this segment of the population with regards to health screening participation.

Materials and Methods

The study population involved all residents aged 40 years and above, living in Blocks 116 to 118 of Taman Jurong Constituency, Singapore, and who have not been screened in the preceding time frame as per specific health screening according to the Singapore Ministry of Health's Clinical Practice Guidelines. The selected blocks were one to two room heavily subsidised public rental flats; residents must have a household income of <\$1500 to be eligible to stay in these flats. The age limit was set based on the Singapore Ministry of Health's Clinical Practice Guidelines for community health screening, which recommend those aged 40 years and above to go for blood pressure screening yearly, fasting blood glucose/lipid every three years; for those aged 50 years and above, to go for fecal occult blood testing (FOBT) yearly; and for married females (whom we presumed to be sexually active) aged 25 to 65 years, to go for Pap smears every three years.⁶ From January 2009 to May 2009, student volunteers made visits to these residents to (1) collect baseline information, such as ethnicity, employment

status, past medical history, health screening participation rates, and perceived (2) barriers and (3) offer the resident the opportunity to participate in free blood pressure, fasting blood glucose and lipid, FOBT, and Pap smear testing, where applicable. Blood pressure was taken using mercury sphygmomanometers, with at least a 30 second interval between measurements and at least two measurements on one occasion. If the resident agreed to participate in FOBT, immunohistochemical FOBT kits (OC Auto-Micro 80®, PolymedCo Inc., New York, USA) were issued and the resident instructed in their use; the samples were placed in a re-sealable bag and mailed back in a pre-paid pre-addressed envelope to the Singapore Cancer Society (SCS) which provided the kits and performed the analysis. Residents who agreed to take part in fasting blood glucose/lipid testing and/or Pap smear had a free screening session organised by the Singapore Anti-Tuberculosis Association (SATA), which conducted the venepuncture in a community centre within a two minute walk from participants' homes (after fasting overnight) and smears; and analysed the samples at their accredited laboratories. For fasting blood glucose, a value of ≥ 7.0 mmol/L was considered positive. For fasting blood lipid, a total cholesterol of ≥ 6.2 mmol/L and/or a triglyceride of ≥ 2.3 mmol/L and/or an HDL < 1.0 mmol/L and/or an LDL ≥ 4.1 mmol/L was considered positive.⁶ All results were reviewed by medical professionals and residents were informed of their results. For those with negative results, results were notified via mail; for positive results, residents were informed personally and follow-up sessions were arranged at public primary clinics. We also asked residents for their reason(s) for not participating regularly in previous health screenings and recorded their qualitative replies. Regular health screening was defined as adhering to the screening frequencies recommended in the Ministry of Health's Clinical Practice Guidelines,⁶ which were: for those aged ≥ 40 years, blood pressure every year, fasting glucose and lipids every three years; for those aged ≥ 50 years, FOBT every year; for females, aged 25 to 65 years and sexually active, Pap smears every 3 years. We then performed thematic analysis to generate a list of reasons for non-participation in health screening and grouped them for quantitative analysis. Ethics approval to conduct the study was obtained from the NUS Institutional Review Board, informed consent was sought from participants, and participation was entirely voluntary.

Statistical Analysis

Descriptive statistics were computed for the study population. We also calculated the number of residents who had regularly gone for health screening both pre- and post-intervention. Chi-square analysis was used to examine the univariate associations between sociodemographic variables and regular participation in health screening for

hypertension, diabetes and hyperlipidaemia. We then used binary logistic regression modelling to adjust for factors suspected to be associated with regular health screening for hypertension, diabetes and hyperlipidaemia such as age, gender, occupation, financial aid and the other chronic diseases screened (e.g. for regular hypertension screening, known diabetes and hyperlipidaemia were also adjusted for). We did not investigate the factors associated with screening for colorectal cancer and cervical cancer because the numbers of people who went for FOBT/Pap smear regularly was small. Statistical analysis was performed using Statistical Package for Social Sciences (SPSS, Version 17.0, USA) and statistical significance was set at the conventional $P < 0.05$.

Results

A majority of eligible residents in our study population participated in the study [participation rate = 60.9% (213/350)]. The profile of participants is detailed in Table 1. The median age was 63.0 years (IQR = 49–76). The female-to-male ratio was about 3:2. About half were Chinese and a third Malay; the rest were Indians and other ethnicities. The mean systolic BP was 136.84 mmHg (SD = 19.1); the mean diastolic BP was 81.0 mmHg (SD = 13.3), and the median capillary blood glucose was 6.10 mmol/L (IQR = 5.2–7.8). Forty-six percent had high systolic BP (>140 mmHg) while 27.2% had high diastolic BP (>90 mmHg). Only about a third of the population was currently employed; 38.5%, 23.5%, 43.0% and 2.8% reported a history of hypertension, diabetes, hyperlipidaemia or cancer, respectively.

The health screening participation rates before and after NHS are detailed in Table 2. While health screening rates for hypertension increased from 18.9% to 97.6% after NHS, there was only a marginal increase in the participation rates for the other modalities. The top 6 barriers to regular health screening in each of the 5 modalities are detailed in Table 3. High cost and a lack of time were cited as the 2 most common reasons why people in this population did not participate in regular hypertension or hyperlipidaemia screening. For diabetes screening, the top 2 reasons were lack of time and the perception that screening was not important. For FOBT, the 2 most common reasons were that the participants felt they were too old to go for health screening or not at risk. For Pap smears, the most common reason was high cost (too expensive), as well as the perception that it was not necessary for healthy people. The factors associated univariately with not going for regular screening are listed in Table 4 and the independent factors associated with not going for regular screening are listed in Table 5. Being unemployed was associated both univariately and in a multivariate model with not going for regular hypertension screening (adjusted OR = 2.48, CI = 1.12–5.53, $P = 0.026$). Being diagnosed with hypertension was associated with going for

Table 1. Profile of Study Population (n = 213)

Characteristic	
Age (y)	
Median (IQR)	63.0 (49–76)
n (%)	
40–49	56 (26.3)
50–59	29 (13.6)
60–69	37 (17.4)
>70	91 (42.7)
Gender, n (%)	
Male	88 (41.3)
Ethnicity, n (%)	
Chinese	111 (52.1)
Malay	68 (31.9)
Indian	26 (12.2)
Others	8 (3.8)
Employment, n (%)	
Currently employed	58 (27.2)
Financial aid, n (%)	
On financial aid	66 (31.0)
Blood pressure (mmHg)	
Mean (SD)	
Systolic	136.64 (19.08)
Diastolic	81.00 (13.27)
n (%)	
>140	98 (46)
>90	58 (27.2)
Self-reported disease status, n (%)	
Known hypertension	82 (38.5)
Known diabetes	50 (23.5)
Known hyperlipidaemia	43 (20.2)
Known cancer	6 (2.8)

diabetes (adjusted OR = 2.26, CI = 1.14–4.49, $P = 0.019$) and hyperlipidaemia screening regularly (adjusted OR = 3.11, CI = 1.46–6.65, $P = 0.003$). People who did not need financial aid were less likely to miss regular screening for hyperlipidaemia (adjusted OR = 0.27, CI = 0.10–0.72, $P = 0.008$). Out of 82 known hypertensives, 27 (32.9%) had not had their BP checked in the preceding 3 years and all (100%) had their BP checked after NHS.

Discussion

As predicted, health screening utilisation in the lower-income segment of the population was much lower when compared against the national averages as a whole. For hypertension screening, only 18.9% of the residents without hypertensive status had had a BP measurement in the past year, as opposed to the national average where 63.9% of

Table 2. Participation in Health Screening for Hypertension, Diabetes, Hyperlipidaemia and Colorectal and Cervical Cancer

Screening modality	Number eligible for health screening as recommended*	Those who had gone for screening as recommended before NHS, n (%)*	Those who were screened at NHS, n (%)	Those who had gone for screening as recommended after NHS, n (%)*	Those who had positive results from screening during NHS, n (%)†
Blood pressure	127	24/127 (18.9)	100/127 (78.7)	124/127 (97.6)	46/100 (46.0)
Fasting blood glucose	159	42/159 (26.4)	7/159 (4.4)	49/159 (30.8)	1/7 (14.3)
Fasting blood lipids	166	31/166 (18.7)	7/166 (4.2)	38/166 (22.9)	3/7 (42.9)
Fecal occult blood test	157	6/157 (3.8)	10/157 (6.4)	16/157 (10.2)	0/10 (0)
Pap smear (females only)	70	2/70 (2.9)	1/70 (1.4)	3/70 (4.3)	0/1 (0)

NHS: Neighbourhood Health Screening

* Based on MOH Clinical Practice Guidelines for Health Screening: For those aged ≥ 40 years, blood pressure every year, fasting glucose and lipids every 3 years. For those aged ≥ 50 years, fecal occult blood test every year. For females aged 25 to 65 years who are sexually active underwent Pap smear every 3 years. Residents were encouraged to go for the relevant health screenings if they had not adhered to this screening regimen previously.

† Positive results defined as: For blood pressure, an average systolic blood pressure of ≥ 140 mmHg and/or an average diastolic blood pressure of ≥ 90 mmHg. For fasting blood glucose, a value of ≥ 7.0 mmol/L. For fasting blood lipid, a total cholesterol of ≥ 6.2 mmol/L and/or a triglyceride of ≥ 2.3 mmol/L and/or an HDL < 1.0 mmol/L and/or an LDL ≥ 4.1 mmol/L.

Table 3. Reasons for not Participating in Regular Health Screening for Hypertension, Diabetes, Hyperlipidaemia, Colorectal Cancer and Cervical Cancer

Reason for not participating in health screening	Blood pressure n (%)	Fasting blood glucose, n (%)	Fasting lipid, n (%)	Fecal occult blood test, n (%)	Pap smear, n (%)
Too expensive	48 (46.6) ¹	24 (20.5) ⁴	37 (27.4) ¹	24 (15.9) ⁵	22 (32.3) ¹
Too busy to go/no time	42 (40.8) ²	28 (23.9) ¹	29 (21.5) ²	19 (12.6) ⁶	18 (26.5) ⁴
Not necessary as I am healthy	10 (9.7) ⁶	20 (17.1) ⁵	26 (19.3) ⁴	28 (18.5) ⁴	20 (29.4) ²
Not at risk	6 (5.8)	26 (22.2) ³	28 (20.7) ³	44 (29.1) ²	19 (27.9) ³
Screening is not important	1 (1.0)	27 (23.1) ²	24 (17.8) ⁵	36 (23.8) ³	18 (26.5) ⁵
Screening is inconvenient	13 (12.6) ⁵	19 (16.2) ⁶	23 (17.0) ⁶	14 (9.3)	5 (7.4)
Too old	8 (7.8)	13 (11.1)	15 (11.1)	49 (32.5) ¹	2 (2.9)
Too young	26 (25.2) ³	10 (8.5)	12 (8.9)	4 (2.6)	5 (7.4)
Do not have a companion/caregiver to go with	24 (23.3) ⁴	10 (8.5)	16 (11.9)	4 (2.6)	2 (2.9)
Cannot do anything if disease is detected	0 (0)	10 (8.5)	14 (10.4)	17 (11.3)	11 (16.2) ⁶
Screening is ineffective in detecting the condition	0 (0)	9 (7.7)	12 (8.9)	11 (7.3)	8 (11.8)
Do not know where to go for screening	0 (0)	3 (2.6)	5 (3.7)	2 (1.3)	4 (5.9)
Went for screening in previous years, so no need to go again*	0 (0)	5 (4.3)	5 (3.7)	2 (1.3)	0 (0)
Afraid of possible side effects	0 (0)	1 (0.9)	2 (1.5)	0 (0)	0 (0)
Never heard about it	0 (0)	0 (0)	1 (0.7)	1 (0.7)	0 (0)
Afraid of knowing the results	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Fated if I get the condition	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Painful test	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Embarrassing (e.g. need to undress, operator not female)†	NA	NA	NA	NA	2 (2.9)
Not sexually active at present, so no need to go†	NA	NA	NA	NA	0 (0)
Uncomfortable with scraping fecal matter‡	NA	NA	NA	1 (0.7)	NA

Participants may report more than one reason. The superscript numbers next to figures are the rank order for each health screening modality.

* People who chose this option had gone for screening before, but were not being screened on a regular basis (i.e. if applicable, subject had not been screened for hypertension yearly, diabetes and hyperlipidaemia every 3 years, FOBT yearly, Pap smear every 3 years)

† These responses were specific for Pap smear

‡ This response was specific for FOBT

Table 4. Univariate Associations with Regular Hypertension, Diabetes and Hyperlipidaemia Screening

Factors	Regularly screened for hypertension				Regularly screened for DM				Regularly screened for hyperlipidaemia			
	No n (%)	Yes n (%)	Crude OR (95% CI)	P	No n (%)	Yes n (%)	Crude OR (95% CI)	P	No n (%)	Yes n (%)	Crude OR (95% CI)	P
Age (y)												
40-69	94 (77.7)	27 (22.3)	1.25 (0.66-2.35)	0.519	84 (70.0)	36 (30.0)	1.53 (0.86-2.71)	0.187	97 (80.8)	23 (19.2)	2.40 (1.29-4.48)	0.007
>70	67 (73.6)	24 (26.4)			55 (60.4)	36 (39.6)			58 (63.7)	33 (36.3)		
Ethnicity												
Non-Chinese	82 (80.4)	20 (19.6)	1.61 (0.85-3.06)	0.152	64 (63.4)	37 (36.6)	0.81 (0.46-1.43)	0.471	75 (74.3)	26 (25.7)	1.08 (0.59-2.00)	0.876
Chinese	79 (71.8)	31 (28.2)			75 (68.2)	35 (31.8)			80 (72.7)	30 (27.3)		
Employment												
Unemployed	98 (77.2)	29 (22.8)	1.92 (0.98-3.78)	0.074	74 (58.7)	52 (41.3)	0.41 (0.20-0.84)	0.013	89 (70.6)	37 (29.4)	0.70 (0.34-1.44)	0.375
Employed	37 (63.8)	21 (36.2)			45 (77.6)	13 (22.4)			45 (77.6)	13 (22.4)		
Gender												
Female	92 (74.2)	32 (25.8)	0.79 (0.41-1.51)	0.518	73 (59.3)	50 (40.7)	0.49 (0.27-0.89)	0.019	90 (73.2)	33 (26.8)	0.97 (0.52-1.80)	1.00
Male	69 (78.4)	19 (21.6)			66 (75.0)	22 (25.0)			65 (73.9)	23 (26.1)		
Financial aid												
Not needed	103 (70.5)	43 (29.5)	0.33 (0.15-0.75)	0.006	94 (64.4)	52 (35.6)	0.80 (0.43-1.50)	0.532	100 (68.5)	46 (31.5)	0.40 (0.19-0.84)	0.018
Needed	58 (87.9)	8 (12.1)			45 (69.2)	20 (30.8)			55 (84.6)	10 (15.4)		
Known hypertension												
No	NA	NA	NA	NA	95 (74.8)	32 (25.2)	2.83 (1.57-5.10)	0.001	107 (84.3)	20 (15.7)	4.19 (2.19-7.99)	<0.001
Yes	NA	NA			42 (51.2)	40 (48.8)			46 (56.1)	36 (43.9)		
Known diabetes mellitus												
No	117 (73.6)	42 (26.4)	0.61 (0.27-1.37)	0.262	NA	NA	NA	NA	124 (78.0)	35 (22.0)	2.57 (1.31-5.04)	0.010
Yes	41 (82.0)	9 (18.0)			NA	NA			29 (58.0)	21 (42.0)		
Known hyperlipidaemia												
No	126 (75.9)	40 (24.1)	1.08 (0.50-2.34)	0.844	115 (69.3)	51 (30.7)	2.15 (1.09-4.26)	0.031	NA	NA	NA	NA
Yes	32 (74.4)	11 (25.6)			22 (51.2)	21 (48.8)			NA	NA		

95% CI: 95% confidence interval; DM: diabetes mellitus; NA: not applicable; OR: odds ratio

Table 5. Independent Factors Associated with Regular Hypertension, Diabetes and Hyperlipidaemia Screening

Factors	Adjusted OR (95% CI)*	P
Regularly screened for hypertension		
Employment	2.48 (1.12-5.53)	0.026
Regularly screened for diabetes mellitus		
Known hypertension	2.26 (1.14-4.49)	0.019
Regularly screened for hyperlipidaemia		
Financial aid	0.27 (0.10-0.72)	0.008
Known hypertension	3.11 (1.46-6.65)	0.003

95% CI: 95% confidence interval; OR: odds ratio

* Adjusted for age, gender, occupation, financial aid and other known chronic diseases screened (e.g. for regular hypertension screening, known diabetes and hyperlipidaemia were also adjusted for).

Singaporeans without known hypertension, aged 40 to 69 years had had a yearly BP check.¹ Similarly, for diabetes and hyperlipidaemia, only 26.4% and 18.7% of healthy individuals had had fasting blood glucose or a fasting blood lipid testing in the past 3 years, respectively, as compared to the national averages of 72.2% and 78.0%.¹ This is similar to the findings of Wong et al⁷ who reported that sociodemographic status was a predictor of screening for diabetes amongst Singaporeans; however the difference is stark. Given that the home ownership rate in Singapore is 90.1%;⁸ the unemployment rate was 2.1% in December 2009,⁹ and the median household income was S\$4950 in 2008,¹⁰ whereas our study population stayed in one to two room rental flats (where the income ceiling was S\$1500) and the unemployment rate was 72.8%, these disparities might explain some of the difference in health screening participation rates. While those with disease have had a blood pressure and fasting blood test more regularly (32.9% for hypertensives, 60.0% for diabetics, 58.1% for hyperlipidaemics), there is still room for improvement in self-monitoring amongst those with disease. The prevalence of past history of diabetes and hyperlipidaemia were 23.5% and 43% in our population with a median age of 63.0 years, as compared to the national averages of 17.3%, and 26.7% for the 60 to 69 years bracket.¹ This is similar to the findings of other studies, which found socioeconomic status to be inversely correlated with diseases like diabetes and obesity in Singapore.¹¹⁻¹³ As this segment of the population is also less likely to see a doctor and thus be diagnosed with disease, the actual burden of disease might well be much higher. Hence, with higher rates of disease and lower rates of screening, chronic disease is likely to be picked up at a later stage in this segment of the population, when complications are more frequent and less amenable to treatment. Cost was one of the most commonly cited reasons

for not attending regular health screenings. As such, factors indicative of financial difficulties, such as unemployment or requiring financial aid, were associated with missing regular health screenings. It was also observed that there was a positive association between being diagnosed for hypertension and regular screening for both diabetes and hyperlipidaemia. A possible reason for this could be that their primary care physician would be more likely to order the additional screening tests for those with hypertension as hypertensives are recommended to go for diabetes mellitus and hyperlipidaemia screening annually by MOH Clinical Practice Guidelines. Another possible reason could be that persons diagnosed with hypertension become more concerned about their health and hence, are more likely to go for regular diabetes and hyperlipidaemia health screening.

We sought to intervene in this population by providing free health screening in close proximity to the residents' homes (either at the neighbouring community centre, which was just a two minute walk from the residents' homes, or within the resident's home itself, in the case of blood pressure). With regard to blood pressure screening, our intervention successfully raised screening rates to 97.6%, which was above the national average. However, despite an intensive programme lasting over the course of 5 months, we were only able to marginally raise the screening rates for fasting blood glucose and lipid, from 26.4% and 18.7% to 30.8% and 22.9%, respectively. Despite addressing the issues of cost and inconvenience, there were still additional issues that affected screening rates for diabetes and hyperlipidaemia. Although cost and lack of time were significant issues for hypertension, diabetes and hyperlipidaemia screenings, it was evident that certain misperceptions about the importance of screening for diabetes/hyperlipidaemia exist amongst those of lower socioeconomic status. Significantly, "not at risk", "screening not important", and "not necessary as I am healthy" were also common reasons for skipping the regular hyperlipidaemia and diabetes screenings; in fact, the perception that screening was not important was the second most commonly cited reason for missing diabetes screenings. Perhaps more needs to be done to change the perceptions of the utility of health screenings amongst those of lower socioeconomic status.

With regards to cancer screening, we looked at two screening modalities, FOBT (for colorectal cancer) and Pap smear (for cervical cancer). Pap smear has been available opportunistically in Singapore since 1964; as such, it is a more widely accepted screening modality, compared to FOBT for which no national screening programme exists.¹⁴ As such, the national participation rates for Pap smear were much higher (59.2% had gone for Pap smear every three years, whereas only about 10% had done FOBT yearly).¹ Similar to findings in other countries, participation in cancer screening was much lower amongst those of lower

socioeconomic status.^{15,16} After intervention, we managed to increase screening rates for FOBT from the national average of 3.8% to 10.2%. For Pap smear, however, screening rates were starkly different from the national average (2.9% compared with 59.2%) and our intervention only marginally improved this rate to 4.3%. This was in line with Asian studies that cited low accessibility and lower socioeconomic status as barriers to Pap smear utilisation.^{17,18} Much more can be done to increase Pap smear take-up in this segment of the population. For Pap smear, the most commonly cited reason for skipping regular Pap smears was cost; however, misperceptions such as “not at risk”, “screening not important”, and “not necessary as I am healthy” were also ranked highly. Clearly, a two-pronged approach focusing on cost reduction as well as changing misperceptions would be of value in increasing the take-up rates for Pap smear amongst those of lower socioeconomic status.

It is clear therefore that more needs to be done by society and policymakers to raise screening rates amongst this segment of the population, given that screening rates pre-intervention were so dismal, and even after free and convenient health screening was provided, improvement was marginal with the exceptions of blood pressure. However, it was gratifying that screening rates for hypertension increased dramatically. Perhaps hypertension screening was the most easily tackled because the most common barriers to BP screening were cost issues (e.g. money, time, convenience), whereas in diabetes, hyperlipidaemia, and cervical cancer screening, the most common barriers were a mix of both cost issues and perception issues. Perhaps in the long run, if this intervention programme was sustained for the long-term, screening rates across all diseases might slowly improve as these perception issues were slowly addressed and overcome. For example, a similar multiple-disease screening programme in Keelung, Taiwan, managed to increase its overall coverage from 14.7% to 34.4% of the target population only after 4 years.¹⁹ Bearing in mind that our intervention programme was largely run by volunteers and screening was subsidised, sustainability and cost-benefit analyses would certainly be issues to consider if such a programme was to be scaled up to improve screening rates amongst this high-risk segment of the populace. Nevertheless, the results do suggest that at least for some screening modalities, adopting such an intensive, community-based, door-to-door approach might be helpful in raising screening rates in this group of people, who are likely to be under-represented at screenings done in clinics/mass public screenings, due to cost and mobility issues.

A limitation of our study was that our definition of lower socioeconomic status only reflected one aspect, that of housing type (rental one to two room flats), but did not completely reflect other facets such as educational background, mean household income or employment

status. However, we used this definition because it made targeted intervention to raise screening rates much more practical – we were able to focus our intervention efforts on a geographically defined area, which would have been harder if household income had been used as such information is difficult to obtain. Also, we did not have a control group, and thus we cannot say with certainty that the rise in screening rates was due to our intervention alone. Moreover, we felt that it was unethical, given the vulnerability of this study population, to introduce a control group to our study. Furthermore, this was a single-site study, and hence the results might not be fully generalisable to all of Singapore. However, considering that it took a year of groundwork (in 2008) to build up trust with these residents to let us into their homes, it would be difficult to replicate this in multiple sites. Studying this segment of the population has its own unique challenges, in that barriers to communication are magnified and trust has to be slowly earned and is not automatically gained. Lastly, this study design was a cross-sectional one which cannot infer causality and is prone to confounders. For example, employment and needing financial aid are inter-related as an unemployed person is more likely to express a need for financial assistance. Moreover, females are generally less likely to be employed as they are more likely to be homemakers and persons ≥ 70 years are also more likely to be unemployed. Thus, it was not surprising that some of the variables which were significant on univariate analysis were no longer significant on multivariate analysis.

In conclusion, despite high national rates of health screening participation amongst the general populace in urban Singapore, more needs to be done to assist those in lower-income and lower socioeconomic strata from falling through the cracks. This is especially crucial for health screening, given that people in these strata are also likely to have a greater prevalence of chronic disease. Moreover, health screening is merely the first step in the marathon of managing chronic disease. A community-based approach that offers this group of people free and convenient health screening may be of use in raising health screening rates in some modalities; however, it is clear that any approach to link these people back into the healthcare system must not just consider screening, but also treatment and management as well.

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