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Title Page

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Title: Hong Kong Chinese Parental Attitudes towards Vaccination and Associated Socio-demographic Disparities

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1. Introduction

Vaccination is among the most successful and cost-effective public health strategies for the prevention and control of many important communicable diseases [1]. In Hong Kong, childhood vaccines are administered under a dual system, following World Health Organization (WHO) recommendations for vaccination provision comprising mandatory and optional vaccines. These are decided by the Scientific Committee of Vaccine Preventable Diseases (SCVPD) under the Centre for Health Protection of the Department of Health (DH) after taking into account relevant factors including local and global epidemiology, disease burden, the safety, efficacy, and vaccine cost-effectiveness and availability [2]. Routine vaccines for B.C.G, Hepatitis B, DPT (Diphtheria, Pertussis and Tetanus), Polio, Pneumococcal, Varicella, and MMR (Measles, Mumps & Rubella) are mandated under government Childhood Immunization Programme (CIP) and provided free of charge to all local-born and resident children, and are a requirement for kindergarten/primary school admission. Optional vaccines for Haemophilus influenza type b, seasonal influenza A, Hepatitis A, Japanese encephalitis, Rotavirus, Meningococcal, and Human Papillomavirus (HPV) are administrated on voluntary basis, the costs of which are fully or partially borne by vaccination recipients. For compulsory vaccines Hong Kong has almost universal immunization coverage rates of 98% or above for local-born 2-5-year-old children and higher than 95% among Mainland-born 2-5-year-old children living in Hong Kong [3], significantly better than many western developed countries/regions [4, 5]. However, in contrast, in Hong Kong optional vaccines have much lower uptake rates, for instance, two common optional vaccines, seasonal influenza and HPV, have uptakes of only 15% among local-born 2-5-year-old children [3] and 9% among teenage girls [6], respectively.

Parents are in a privileged position to control young children’s access to vaccines. Personal beliefs about and general attitudes to vaccination may affect how parents view the risks and benefits of vaccination for their children. Therefore, understanding general attitudes of parents towards vaccination is important. Most previous studies have focussed on specific vaccines, and very few studies have investigated parental

attitudes towards vaccination in general [7]. Previous local qualitative studies found that Hong Kong Chinese parents hold generally positive attitudes towards childhood vaccination, but often attach much less importance to optional vaccines compared to mandatory vaccines [8, 9].

Having a better understanding of parental attitudes towards childhood vaccination and associated socio-demographic disparities can help to inform targeted vaccination communications and therefore increase vaccination coverage. However, existing findings are inconsistent. Some studies reported no associations between parental socio-demographic variables including ethnicity, age, education, and religion and parental vaccination acceptance [10, 11] or with parents' general attitudes towards vaccination [7], whereas other studies reported significant association between parental socio-demographic characteristics and vaccination acceptance [12, 13]. To the authors' knowledge, there is no published quantitative study using population-based data that examines Chinese parental attitudes to vaccination by socio-demographic characteristics. This report aimed to fill that research gap.

2. Methods

2.1 Participants and Procedure

As part of a longitudinal investigation of parental decision-making regarding HPV vaccination (approved for use in females from the age of 9 years in Hong Kong) for girls, Chinese parents with at least one daughter aged 12-17 years living in a Hong Kong household, having heard of HPV vaccine but not yet vaccinated daughters against HPV were interviewed by random digit-dialling telephone interviews. To avoid oversampling of non-workers, most interviews were conducted between 18:30 and 22:30 on weekdays, and between 14:00 and 22:30 at weekends. Households with non-answered phone numbers were redialled at least 6 times more in different periods before being dropped [14]. Verbal consent was obtained from each eligible participant prior to interview. Ethical approval was obtained from the Institutional Review Board of the University of Hong Kong/Hospital Authority Hong Kong West Cluster. The present report details baseline survey data.

2.2 Outcome measures

Measures of parental attitudes to vaccination were developed from the findings of earlier qualitative studies on Hong Kong and mainland Chinese immigrant parents [8, 9] and empirical literature. Consisting of 6 items on 5-point agreement scales (from 1 "Strongly disagree" to 5 "Strongly agree"), the Cronbach's α for the 6 items was 0.74, indicating acceptable internal consistency [9]. Principal components analysis suggested two factors underlying the scale. One, *supportive attitude to vaccination* consisted of 2 items ("Vaccinating is an effective way for infectious diseases prevention" and "Vaccinating is beneficial") had a Cronbach's α of 0.61. Possible scale scores ranged from 2 to 10 with higher score indicating more positive attitude to vaccination. The second factor, *hesitant attitude towards (optional) vaccines* comprised 4 items: "Optional vaccines are not important", "It is not necessary to vaccinate children with optional vaccines", "If possible, I do not want to give my child(ren) any vaccines", and "Too many vaccines will harm children's immunity". The Cronbach's α for these 4 items was 0.72, with possible scores ranging from 4 to 20, higher scores indicating more hesitant attitudes regarding (optional) vaccination. Because our earlier study found that Chinese parents who have purchased private health insurance for children reported higher intention to accept optional vaccine [14], participants were asked if they had purchased private health insurance for children even though private health insurance policies in Hong Kong usually do not cover costs of vaccination. The questionnaire was reviewed by a panel of public health experts to check the instrument's content and face validity and then pilot-tested among 30 Chinese parents before the main fieldwork started.

2.3 Data Analysis

Descriptive statistics were used to detail the sample demographic characteristics and to summarize the variables. The variance inflation factors (VIFs) of all independent variables (IVs) were examined to test for potential multi-collinearity among IVs [15]. VIFs ranged from 1.03 to 3.38, below the cut-off of 5.00 [16], implying no significant problems of multi-collinearity. Multiple linear regression analyses were next

conducted to examine association between socio-demographic variables and the two indices of parental attitudes to vaccination. All analyses were performed using SPSS version 20.0 and $p<0.05$ was considered statistically significant.

3. Results

Between February and November 2014, 1,996 eligible Hong Kong Chinese parents completed the telephone interviews (response rate 60%). Most respondents (74.4%) were mothers. Around 56% of the participants had HK$20,000 or above monthly household income, comparable with the median domestic income (HK$20,500) of Hong Kong in 2011 [17]. One third (659, 33%) of participants reported religious affiliation (mainly including Christianity (350, 17.5%), Buddhism (210, 10.5%), and Catholicism (84, 4.2%)). (**Table 1**)

Almost all (84.4-100%) parents reported their children had received all age-appropriate routine vaccines under the CIP. Overall 852 (42.7%) parents reported their children ever experienced vaccination side-effects, most commonly fever (716, 35.9%), soreness/swelling at the injection site (349, 17.5%) and poor appetite (67, 3.4%).

Most (91.6%) participants agreed that vaccination was effective for preventing infectious disease, and 78.7% considered vaccination beneficial. However, 39.5% of parents interviewed regarded optional vaccines as unimportant and three fifths (62.1%) felt it was unnecessary to give their children optional vaccines. One in two (49.4%) participating parents believed that too many vaccines can harm children's immune systems, and one in five (22.0%) said that they would not give their children any vaccines if not mandated by government (**Figure 1**). Overall, Hong Kong Chinese parents held supportive attitudes towards vaccination generally (Mean=7.49/10, SD=1.74) but showed less supportive attitudes towards optional vaccines (Mean=13.10/20, SD=3.17).

Parents born in Hong Kong (β=-0.170, $p<0.001$), females (β=-0.077, p=0.007), those married (β=-0.052, p=0.041), and whose children had experienced adverse effects from vaccination (β=-0.084, p=0.001) expressed less supportive attitudes towards

vaccination, whereas parents with more children (β=0.070, p=0.005) held more favorable attitudes towards vaccination. Parents with lower personal income (β=-0.116, p=0.013) and who reported religious affiliations (β=-0.052, p=0.036) tended to express more hesitant attitudes towards (optional) vaccines (**Table 2**).

4. Discussion

Although most of this sample of Hong Kong Chinese parents reported positive attitudes towards vaccination in general, between two and three fifths respectively considered optional vaccines unimportant and unnecessary. This is consistent with local qualitative study findings [8, 9] that Chinese parents rely heavily on government recommendations to judge the importance and necessity of childhood vaccines. This goes a long way to explaining the huge uptake rate gap between mandatory and optional vaccines.

Low vaccination knowledge does not necessarily translate into negative attitudes; factors including trust, for example in health-care providers and their motives or 'western' medicine, and culture may be more influential [18]. Yet, in the present study one-in-two participating parents believed, against prevailing medical understanding, that children's immune system is weakened as a result of too many vaccines. Other studies on western populations have reported that parents who prefer 'natural immunity' (a belief that it is better to develop immunity from catching an infection than from vaccination) were often less likely to vaccinate children [19, 20]. This may reflect a similar phenomenon.

Demographic disparities associated with parental attitudes were substantial. Locally-born married mothers with few children and whose child(ren) have experienced vaccination side-effects were significantly less likely to hold supportive attitudes towards vaccination generally while parents with religious affiliation and lower personal incomes expressed more hesitant attitudes towards optional vaccines. These findings are again consistent with previous local qualitative findings [8, 9]. In particular, we quantified that a high 22% of Chinese parents tend to reject all vaccines

for children if not mandated by government. Because mandated vaccines are required for entry to the school system, this suggests that vaccination is passively accepted by parents, but large numbers may be prone to oppose vaccine recommendations that are not mandated. While this might reflect Chinese collectivist cultures and traditional values which respect social order, status hierarchies, and government policies, it could also reflect the pragmatism that some vaccines (all mandated) are necessary for kids to go to school, a more likely explanation.

Nevertheless, causal relationships between the variables should not be drawn from this cross-sectional data. Being a secondary report from a larger HPV vaccination decision-making study the required recruitment criteria therefrom, may mean participants are unrepresentative of the general Hong Kong parental population. However, we endeavoured to minimize bias and maximize representativeness by using random sampling, and the study findings are consistent with earlier childhood vaccination decision-making studies in Hong Kong [8, 9]. Exclusion of parents who had vaccinated their daughters with HPV is unlikely to bias results because the HPV vaccination uptake is <10%. So there is good reason to believe that this report presents a valid and reliable picture of the situation faced by many Chinese parents in Hong Kong.

In conclusion, mandating childhood vaccines, particularly as a school entry requirement, effectively helps maintain universal vaccination coverage in Hong Kong and possibly in other Chinese-dominated societies. If government recommends optional vaccines through future public education and vaccination campaigns this should help counter some of the suspicion about (usually) fiscal motives when (mostly private) doctors recommend optional vaccines. Clarification of their importance and necessity can also help to provide explicit guidance to practitioners as well as parents. Communication efforts should focus on the benefits and importance of optional vaccination as well as emphasize the importance of individual responsibility to make informed decisions about optional vaccines for personal protection, particularly among lower-income parents and those with religious affiliations. If a vaccination is considered beneficial, then government should consider provision, and if high uptake is required, vaccinations should be free of charge and made mandatory.

Conflict of interest statement

The authors declare that they have no conflict of interests.

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Author contribution

All authors contributed toward the conception and design of the study. LDLW contributed to data analysis and interpretation, drafted and revised the manuscript. WWTL and RF contributed toward study design and revising the manuscript critically. All authors have approved the final article.

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Table 1 Characteristics of participants, Hong Kong 2014 (N=1996)

Characteristics	n	% [a]
Age (years)		
30-39	130	6.5
40-49	1081	54.2
50-59	733	36.7
≥60	40	2.1
Gender		
Female	1485	74.4
Male	511	25.6
Marital status		
Married	1883	94.3
Single/Divorced/Widowed/Separated	106	5.3
Educational level		
Primary or below	161	8.1
Secondary	1365	69.4
Tertiary or above	441	22.1
Employment status		
Employed	1114	55.8
Currently non-salaried/unemployed	865	43.3
Personal income (HK$/month)		
No income	665	33.3
1- <10,000	366	18.3
10,000 - <20,000	419	21.0
20,000 - <40,000	255	12.8
≥40,000	196	9.8
Family income (HK$/month)		
<10,000	148	7.4
10,000 - <20,000	506	25.4
20,000 - <40,000	575	28.8
≥40,000	547	27.4
Birth place		
Hong Kong	1253	62.8
Mainland China	671	33.6
Elsewhere	26	1.3
Number of children		
1	565	28.3
2	1084	54.3
3	289	14.5
≥4	58	2.9
Had religious affiliation	659	33.0
Children ever experienced vaccination adverse effects	852	42.7
Had health insurance for children	924	46.3

[a] Unaccounted percentage is missing data.

Table 2 Socio-demographic factors associated with parental attitudes to general vaccination and towards optional vaccines, Hong Kong 2014 (N=1996)

	Supportive attitude to vaccination		Hesitant attitude to (optional) vaccines	
	β	*p*	*β*	*p*
Gender (Female)	**-.077**	**.007**	-.022	.451
Age	.039	.124	.028	.276
Birth in HK	**-.170**	**<.001**	.007	.799
Married	**-.052**	**.041**	-.021	.424
Educational level	.020	.489	-.004	.881
Number of children	**.070**	**.005**	-.022	.394
Employed	-.039	.298	.056	.138
Personal income	.032	.478	**-.116**	**.013**
Family income	.017	.613	.051	.141
No religious affiliation	.032	.189	**-.052**	**.036**
Had health insurance for children	-.002	.944	-.007	.796
Child(ren) experienced side effects of vaccination	**-.084**	**.001**	.014	.582

Figure 1 Distribution of agreement towards items measuring Hong Kong Chinese parental opinions about vaccination, 2014 (N=1996)