Public Health in Practice 10 (2025) 100660

Contents lists available at ScienceDirect

Public Health in Practice

journal homepage: www.sciencedirect.com/journal/public-health-in-practice

A theory- and evidence-based holistic intervention to enhance the uptake of preventive eye examination among the elderly centre members

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ARTICLE INFO

Keywords:
Behaviour change wheel
COM-B model
Preventive eye examination
Service uptake
Intervention development

ABSTRACT

Objective: To develop a theory-driven and evidence-based intervention to enhance the uptake of preventive eye examinations of older adults in Hong Kong.
Study design: A cross-sectional study to inform the development of intervention.
Methods: Intervention development was informed by the Capability-Opportunity-Motivation Behaviour (COM-B) Model and the Behaviour Change Wheel through an eight-step approach. Key stages included identifying the missing behavioural drivers and considering the intervention options and implementation options to improve service uptake. Findings were evaluated against APEASE criteria and supplemented by the feedback from advisory group consultations.
Results: The barriers deterring preventive eye examination uptakes reflected deficits in psychological capability, social opportunity, physical opportunity, reflective motivation, and automatic motivation. An intervention requires seven intervention functions to address these deficits, including Education, Persuasion, Incentivisation, Training, Environmental Restructuring, Modelling and Enablement. The intervention aims to create a supportive environment in the elderly centre and lay referral networks to empower older adults to access health-related and service-related information, allowing access to appropriate social support. Better health communication of service-related information, more effective communication of appointment booking, and mobile service provision modes were proposed to enable older adults to attend future appointments.
Conclusions: Informed by the Behaviour Change Wheel framework, a holistic intervention to address the multiple barriers to preventive eye examination uptake was developed. The findings indicated that strategies beyond health education and service provision should be considered. A multi-component intervention, including service providers, service recipients and community social workers, should be considered to effectively address the barriers to service uptake.

1. Introduction

Vision declines inevitably with age. The major causes of vision loss and blindness for older adults were uncorrected refractive errors and cataracts, which are reversible through treatment [1]. Other causes of irreversible vision loss and blindness include diabetic retinopathy, glaucoma and age-related macular degeneration, can benefit from early detection and timely treatment to slow down disease progression to prevent severe visual impairment [1]. Undergoing an eye examination every one to two years is recommended for older adults [2,3]. However, suboptimal eye examination utilisation is an international issue, as evident in a two-year interval uptake rate ranging from 9 % to 85 % worldwide [4,5]. To safeguard the visual well-being of older adults, action must be taken to ensure that older adults are demanding the services they need [6,7].

Multiple factors were found to influence preventive eye examination uptakes. Higher eye examination uptakes were associated with people with more comorbidities [8–10], diabetes [4], and requiring glasses [4]. On the other hand, people from a lower income bracket [4,5,9,10], living in the rural area [10], being male and from a younger age group, were associated with lower eye examination uptakes [4,9]. Cost is a frequently cited barrier [11]. But even with a funded eye examination, other barriers existed, including the cost of purchasing glasses, lack of eye health-related knowledge and awareness, limited access to available

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https://doi.org/10.1016/j.puhip.2025.100660
Received 13 August 2025; Accepted 24 September 2025
Available online 1 October 2025

services and negative ageing perception associated with wearing glasses [12]. Subjective health beliefs [13–15], such as perception about ageing and vision decline [8,12], perception towards the service provider and negative experiences also influenced motivation to undergo an eye examination [12].

There are few randomised controlled trials (RCT) that investigated interventions to improve non-disease specific eye examination uptake, like comprehensive preventive eye examination, for the general older adult population. Different delivery modes of health educational interventions (including eye health programmes [16], multimedia [17], tailored messages [18]) and mobile service provisions were studied [15]. However, none of the health education interventions were found to significantly improve the uptake of preventive eye examination, compared to the respective control group without such educational intervention. One RCT found that providing mobile service screening (35.6 %) increased service uptake significantly when compared to no screening (4.5 %) [15]. This indicates that more systemised strategies beyond health education and service provision are required to address the multifactorial barriers to service uptake.

Having a theory- and evidence-based intervention development facilitates the understanding of the rationale behind intervention design, aiding subsequent evaluation and refinement [19,20]. The Behaviour Change Wheel (BCW) provides a systematic approach to designing behaviour change interventions [19]. The framework includes the Capability-Motivation-Opportunity-Behaviour (COM-B) model, which states the three key drivers of behaviour change. The COM-B model is linked to a list of intervention functions and policy-level categories that can be selected to address specific missing COM-B components [19]. This framework guides intervention designers to consider a comprehensive list of intervention options to change the target behaviour, which can address the identified research gap of limited interventions being investigated within the literature.

Similar to other parts of the world [21], Hong Kong (HK) is also facing population ageing [22] and suboptimal preventive eye examination uptake by older adults [23]. HK operates a dual healthcare system [24], with preventive eye examinations requiring out-of-pocket payment by service users. HK citizens aged 65 years or above are eligible for an elderly healthcare voucher of HKD 2000 annually, which can be used to cover expenses for a range of private healthcare services [25,26]. The total accumulation limit for the elderly healthcare voucher is HKD 8,000, and the maximum voucher expense allowance for optometry services is capped at HKD 2,000 every two years [25,26]. Despite the voucher scheme, a local survey reported that 22.2 % of the older adults never had an eye examination before, and although 38.4 % had an eye examination, it was beyond the recommended two-year interval [23].

This study aimed to apply the BCW framework to propose a theory- and evidence-based intervention to promote preventive eye examination uptake by older adults in HK.

2. Methods

This study was approved by the Hong Kong Polytechnic University Institutional Review Board (reference number: HSEARS20230320002).

2.1. A BCW-informed intervention development process

The BCW provides a systematic eight-step approach to intervention development [27]. For our study, we identified that reducing avoidable blindness is an issue that needs to be resolved (Step 1). Regular uptake of preventive eye examinations (every one to two years) allows regular monitoring of visual health, which facilitates early detection of ocular abnormalities [28]. Therefore, encouraging regular uptake of preventive eye examinations is selected as the target behaviour that could address the identified health issue (Step 2 and Step 3).

2.2. Step 4 – 5: Identification of COM-B components and intervention functions

The COM-B model was used to examine the factors that may prevent older adults from attending preventive eye examinations. According to the model, capability, opportunity and motivation influence one another and work together to shape behaviour. Enhancing either capability or opportunity can help strengthen motivation [19].

The COM-B analysis was based on our previous qualitative study, which conducted individual interviews on 25 older adults [29]. Using grounded theory to analyse the collected qualitative data, a total of 14 sub-themes were derived to explain the barriers influencing preventive eye examination uptake [29]. These subthemes were treated as an analysis unit to identify what was missing in terms of capability, opportunity and motivation. The primary researcher independently mapped each subtheme to the COM-B components (Step 4), and the analysis was supplemented by the Theoretical Domain Framework (TDF) to identify theoretical determinants for the intervention target [27].

All the intervention functions that can be considered to change behaviour were mapped out according to the links between COM-B and intervention functions suggested in the design guide (Step 5) [27]. The APEASE criteria (acceptability, practicability, effectiveness, affordability, side effects and equity) guided the decision of selecting appropriate intervention functions to address the deficit COM-B components [27]. We prioritised the indicators that were more feasible for assessment before implementation, i.e. practicability and acceptability. Existing evidence on the effectiveness of intervention functions was then considered [30,31]. We supplemented the decision with input from stakeholders. Apart from exploring the acceptability and practicability, the stakeholders were asked to share their thoughts regarding the strategies. In cases where stakeholders did not express concerns about a specific criterion, the impact of that criterion on the feasibility of implementation was considered minimal.

Findings from Step 4 and Step 5 were discussed with the supervisor, who independently performed COM-B mapping to ensure research quality.

2.3. Step 6: Identification of policy options

Step 6 involves identifying policy categories that could facilitate the implementation of the intervention functions selected in Step 5. However, this was beyond the scope of this study. Therefore, the policy options were not included in the intervention development phase.

2.4. Step 7–8: Identification of behaviour change technique and mode of delivery

According to the Behaviour Change Technique Taxonomy (BCTTv1) [32], there are 93 behaviour change techniques (BCTs) to consider for each intervention function. We followed a systematic approach to select the appropriate BCTs [27]. Starting with the frequently used BCTs, those with previous application and proven evidence on improving uptake of any type of eye examination or general health checks were considered [30,31]. Less frequently used BCTs were then considered. All the identified BCTs were collated into an intervention summary with a detailed content description and mode of delivery. We referred to the COM-B model to guide how the BCTs could be grouped into a programme to enhance capability and opportunity which can influence motivation to attend preventive eye examinations. The proposed intervention strategies aimed to address the barriers identified in the qualitative study [29].

2.5. Advisory group involvement

The preliminary intervention design was first discussed with experts from health economics, healthcare governance and optometry. It was

followed by advisory group discussions with different stakeholders, including three senior practising optometrists (clinical service providers), two elderly centre staff (social service providers) and two older adults (service users). All members, except the older adults, received an English version of the preliminary intervention strategy. The older adults received a Chinese-translated version to ease their understanding. The stakeholders' input was considered at the stage of assessing the APEASE criteria of the intervention strategies, and their feedback was used to finalise the intervention design and descriptions.

All advisory group discussions were not audio-recorded due to privacy protection concerns. Instead, notes were taken by the primary researcher.

3. Results

3.1. COM-B analysis results (step 4) and the identified intervention functions (step 5)

The results from COM-B analysis revealed that older adults lacked psychological capability (but not physical capability), social opportunity and physical opportunity and had low automatic motivation and reflective motivation to undergo preventive eye examinations (Table 1).

To address the deficits in COM-B components identified above, seven out of nine intervention functions were identified as feasible options, which included Education, Persuasion, Incentivisation, Training, Environmental Restructuring, Modelling and Enablement (Table 1). Restriction and coercion were not considered feasible options. Although there were competing healthcare needs, older adults would need to take action to maintain other aspects of their health [29], therefore, this type of health behaviour should not be restricted (Restriction). Preventive eye examinations should not be associated with coercive measures (Coercion), as they are health-promoting behaviours that rely on informed consent and personal choice. While coercion can be effective in certain high-risk contexts, its use raises ethical concerns and must be justified [33]. In this case, mandating eye examinations would be ethically inappropriate and likely counterproductive. Promoting uptake should instead focus on enabling strategies such as education, accessibility, and trust-building.

3.2. Selection of BCTs to serve the identified intervention functions (step 7 & 8)

Two relevant systematic reviews on interventions to improve DR screening attendance and general health check uptake were identified [30,31]. These reviews have identified a total of 29 BCTs (DR screening) and 15 BCTs (health check), which have included four additional BCTs that were not part of the suggested BCTs for the corresponding intervention functions in the BCW design guide, which were 1) Material reward (behaviour); 2) Monitoring of outcome(s) without feedback; 3) Feedback on outcome(s) of behaviour/biofeedback, 4) Behaviour cost.

Table 2 summarises the evidence supporting the suggested most frequently and the less frequently used BCTs for the corresponding intervention functions and the source(s) of evidence. The full list of frequently used BCTs suggested for each intervention function and those supported by existing evidence can be found in Table S1 of Supplementary Material 1.

3.3. Initial proposal of intervention to improve uptake of preventive eye examination

A preliminary intervention was proposed based on the outlined steps and was discussed with advisory group members. In summary, the strategy was proposed for implementation within a community optometrist network aiming to facilitate the regular provision of health promotion activities and eye examinations to the target service users. Empowering the social network of the older adults, including elderly centre staff and peers (as ambassadors or volunteers), was proposed. This aimed to facilitate the delivery of health and service-related information to educate and persuade the importance of regular preventive eye examination uptake through multiple information channels (e.g. written materials, VA chart, health promotion videos) and innovative means (e.g. use of glasses specifically designed to simulate the consequence of vision loss caused by different eye diseases).

During service provision, the need for regular eye examinations should be effectively communicated to enable older adults to plan and attend the next eye examination appointment. First, it could be achieved by providing an opt-in appointment in which the healthcare provider would schedule their next appointment for the service user (with rescheduling available), along with appointment reminders (in different formats, e.g. telephone, short-message-service reminders, appointment letter). To increase the motivation of older adults, we proposed to include a sentence in the appointment letter praising older adults for attending a scheduled appointment (an example of social reward). Second, informing older adults that an opt-in discount code would be available if they attended the next scheduled appointment.

3.4. Feedback from the advisory group and amendments made to the initial proposal

The discussion with advisory group members did not result in changes to the selected intervention functions, but it enhanced the clarity and acceptability of the specified strategies. One important amendment ensured the proposed strategy aligned with the code of practice for optometrists, i.e. service should not be announced as "free" or "discounted". Therefore, the strategy of providing a discount code for eye examination was removed (as it violated point 5.4 of the code of practice) [34]. Further comments concerned the long-term sustainability of the programme, especially those involving peer ambassadors and mobile service provision. Overall, the advisory group members perceived these strategies implemented as a programme to be effective. Strategies designed to encourage older adults to actively participate in these activities were perceived to be more appealing by older adults. A summary of the feedback related to the amendments of strategies can be found in Table S2 of Supplementary Material 1.

3.5. Final intervention strategy

Table S3 of Supplementary Material 1 provides a detailed report of the final strategy aligned with the relevant intervention functions, COM-B and TDF.

4. Discussion

This study is the first to systematically apply the COM-B model and BCW framework to propose interventions to encourage preventive eye examinations among older adults. By strengthening collaboration among service users, clinical service providers and community social workers, the intervention strategies aimed to tackle five out of six key behavioural drivers in seeking preventive eye examinations: psychological capability, social opportunity, physical opportunity, reflective motivation and automatic motivation. Notably, physical capability was not identified, which describes the physical ability to access the eye examination [19].

A previous qualitative study found that older adults in HK lacked perceived needs, had limited confidence in accessing the services, and lacked trust towards service providers [29]. We identified seven out of nine intervention functions that address the underlying COM-B behavioural drivers (i.e. Education, Persuasion, Incentivisation, Training, Environmental Restructuring, Modelling and Enablement). Our findings have expanded the range of intervention strategies to improve service uptake, beyond those investigated in previous studies [15–18]. We recommend implementing strategies that serve these intervention

Table 1
COM-B analysis and the intervention functions suggested by the BCW framework.

Themes	Sub-themes	COM-B components	Intervention functions[a]								
			Education	Persuasion	Incentivisation	Coercion	Training	Restriction	Environmental Restructuring	Modelling	Enablement
Previous healthcare utilisation as a reference for judging primary eye care	1. Symptom-driven and externally cued health seeking habit	Reflective motivation	x	x	x	x					
		Social opportunity						x	x	x	x
	2. Greater reliance on the public health sector	Reflective motivation	x	x	x	x					
		Physical opportunity					x	x	x		x
		Social opportunity						x	x	x	x
	3. Health care expenditure as financial burden	Physical opportunity					x	x	x		x
Perceiving limited primary eye care service needs	4. Symptom-driven primary eye care needs	Reflective motivation	x	x	x	x					
		Automatic motivation		x	x	x	x		x	x	x
		Psychological capability	x				x				x
	5. Social influences on primary eye care needs appraisal	Social opportunity						x	x	x	x
		Reflective motivation	x	x	x	x					
	6. Limited understanding of the significance of primary eye care	Psychological capability	x				x				x
		Reflective motivation	x	x	x	x					
	7. Competing with other healthcare needs	Reflective motivation	x	x	x	x					
Perceived low self-efficacy on routine eye examination utilisation	8. Concern over service fees for routine eye examinations	Psychological capability	x				x				x
		Social opportunity						x	x	x	x
		Physical opportunity					x	x	x		x
		Reflective motivation	x	x	x	x					
	9. Limited information on service availability	Psychological capability	x				x				x
	10. Limited social support	Social opportunity						x	x	x	x
	11. Low health literacy	Psychological capability	x				x				x
		Social opportunity						x	x	x	x
Service expectations	12. Perceived qualities of a good primary eye care provider: patient-centred service and competence	Social opportunity						x	x	x	x
		Reflective motivation	x	x	x	x					
	13. Acceptable service fee	Physical opportunity					x	x	x		x
		Reflective motivation	x	x	x	x					
	14. Accessible location	Reflective motivation	x	x	x	x					
		Physical opportunity					x	x	x		x

The themes and sub-themes were extracted from Lau et al. [29].

[a] Intervention functions indicated in this table was based on the suggested linkage stated in the design guide [27].

Table 2
Evidence-based behaviour change techniques considered in the intervention design.

Intervention function	BCT(s)	Usage[a]	Evidence-based[b]
Education	Feedback on behaviour	Most	DRS
	Information about health consequences	Most	DRS, HC
	Information about social and environmental consequences	Most	DRS, HC
	Prompts/cues	Most	DRS, HC
	Information about others' approval	Less	DRS, HC
	Self-monitoring of outcome(s) of behaviour	Less	DRS
Persuasion	Credible source	Most	DRS, HC
	Feedback on behaviour	Most	DRS
	Information about health consequences	Most	DRS, HC
	Information about social and environmental consequences	Most	DRS, HC
	Framing/reframing	Less	HC
	Information about others' approval	Less	DRS, HC
	Salience of consequences	Less	DRS
	Social comparison	Less	DRS, HC
	Verbal persuasion about capability	Less	HC
Incentivisation	Feedback on behaviour	Most	DRS
	Commitment	Less	DRS
	Self-monitoring of outcome(s) of behaviour	Less	DRS
	Social reward	Less	DRS
Environmental restructuring	Adding objects to the environment	Most	DRS
	Prompts/cues	Most	DRS, HC
	Restructuring the physical environment	Most	DRS
	Restructuring the social environment	Less	DRS
Modelling	Demonstration of the behaviour	Most	DRS
Training	Behavioural practice/rehearsal	Most	DRS
	Demonstration of the behaviour	Most	DRS
	Instruction on how to perform a behaviour	Most	DRS, HC
	Graded tasks	Less	DRS
	Self-monitoring of outcome(s) of behaviour	Less	DRS
Enablement	Action planning	Most	DRS, HC
	Adding objects to the environment	Most	DRS
	Goal setting (behaviour)	Most	DRS
	Goal setting (outcome)	Most	DRS
	Problem solving	Most	DRS
	Restructuring the physical environment	Most	DRS
	Review behaviour goal(s)	Most	DRS
	Social support (practical)	Most	DRS
	Social support (unspecified)	Most	DRS, HC
	Anticipated regret	Less	HC
	Commitment	Less	DRS
	Comparative imagining of future outcomes	Less	HC
	Framing/reframing	Less	HC
	Graded tasks	Less	DRS
	Incompatible beliefs	Less	HC
	Restructuring the social environment	Less	DRS
	Salience of consequences	Less	DRS
	Self-monitoring of outcome(s) of behaviour	Less	DRS
	Social support (emotional)	Less	DRS
	Verbal persuasion about capability	Less	HC

BCT = behaviour change technique; DRS = diabetic retinopathy screening; HC = health check; Most = most frequently used BCT for an intervention function; Less = less frequently used BCT for an intervention function.

[a] This refers to whether the BCT(s) are most frequently or less frequently used for the corresponding intervention function as suggested in the design guide [27].

[b] Evidence was based on a systematic review on interventions to improve DRS attendance [30] and a systematic review on interventions to improve general health check uptake [31].

functions together as a programme to maximise the potential for improving preventive eye examination uptake for older adults.

The intervention comprised health promotion activities such as training and health education that utilise modelling (social influence through peer sharing) and training to enhance motivation to use preventive eye examinations. The programme will also involve activities to persuade people about the importance of regular eye examination uptake by using glasses designed to simulate vision loss caused by different eye diseases. This was designed to improve older adults' perception of the need for regular eye examinations. Creating an empowering and supportive environment at the elderly centre, by including elderly centre staff and peers, can increase psychological capability (acquiring and understanding necessary information) to make informed healthcare decisions and facilitate access to services (by providing mobile service at the elderly centre). By collaborating with community optometrists to implement these health promotion activities at elderly centres and ensuring effective communication during eye examination appointments, the opportunity and motivation to access preventive eye examinations are anticipated to increase.

Unlike earlier studies that focused on isolated factors such as knowledge (capability) or cost (opportunity) [16–18,23], this study takes a more comprehensive approach by addressing all components of the COM-B model. The use of BCTs enabled a more precise, theory-informed design process, allowing us to link identified behavioural barriers with specific, evidence-based intervention components. This approach goes beyond simply providing people with information or financial support. It allows us to design a more well-rounded and practical set of strategies that reflect the real-life needs, preferences, and challenges faced by older adults.

4.1. Limitations

Although the proposed strategies are theoretically effective and feasible for influencing the target behaviour, limitations were identified regarding the evidence used to inform the intervention design, guided by the APEASE criteria [27]. Due to the lack of empirical evidence, the advisory group discussion primarily focused on assessing acceptability and practicability [35]. Other indicators (i.e. cost-effectiveness, equity) were either more relevant to the intervention evaluation phase or not relevant to the target behaviour (side-effect). Nevertheless, stakeholders commented on the perceived effectiveness and affordability of the strategies, which had informed the final intervention design.

Another limitation concerns the external generalisability of the results. The strategies proposed for implementation in the elderly centre may have lower external generalisability to other population groups, such as individuals who are not elderly centre members or under a different healthcare system as HK. Additionally, these elderly centres were located close to the neighbourhood and the centre members were generally more active. This implies that the findings may not be generalisable to older adults living in rural regions or those with disabilities, as other access barriers may also influence eye examination uptakes [36,37]. Nevertheless, in other contexts, a trusted third party – existing in various forms – can assist in establishing and maintaining connections between service providers and service recipients. The identified BCTs in the current intervention will enable future researchers to adapt the intervention content to suit the needs of various populations or healthcare settings.

4.2. Implications

Although reducing avoidable blindness has been a public health initiative [38], there has been limited discussion of strategies to improve preventive eye examination uptake both locally and internationally. This study has identified a range of theory- and evidence-based strategies that would be useful for future implementation to achieve this aim.

For local implications, elderly centres should consider implementing regular preventive eye health promotion activities for both centre members and staff. Future research is needed to determine how training materials can be designed to effectively create a supportive environment.

Additionally, future research should investigate how to incorporate opt-in appointment and reminder systems into the workflow without overloading the service provider. Aligning the expectations of the service users is important to ensure a positive service experience to improve service uptake [29].

More importantly, future investigation is needed to determine the actual effectiveness of the proposed strategies in improving preventive eye examination uptake. Additionally, stakeholders have expressed concern about the programme sustainability, suggesting that once the strategies are proven effective, a cost-effectiveness analysis of the programme should be conducted. Providing quantifiable information will enable healthcare policymakers and stakeholders to allocate resources effectively to encourage preventive eye examination uptake among older adults through the proposed intervention strategies.

Ethical approval

This study has been approved by the University Institutional Review Board (reference number: HSEARS20230320002).

Funding

The work described in this paper was fully supported by a grant from the Research Grants Council of the Hong Kong Special Administrative Region, China (Project No. PolyU 15607423).

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Acknowledgements

We also want to thank Dr Rita Sum, Dr Vincent Ng and Ms Queenie Yip for the advice and opinions they provided during intervention development.

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.puhip.2025.100660.

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