


Applying the Capability, Opportunity, and Motivation Behaviour Model (COM-B) to Guide the Development of Interventions to Improve Early Detection of Atrial Fibrillation

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ABSTRACT

OBJECTIVE: The primary objective of this study is to use the Capability, Opportunity, and Motivation Behaviour (COM-B) model to identify potential strategies aimed at improving the early detection of atrial fibrillation (AF) in the general population.

METHODS: We undertook a review of the literature to identify factors associated with participation in community-based screening for AF, followed by mapping of the factors generated into the components of the COM-B model, and validation of the model by an expert panel. The Behaviour Change Wheel (BCW) was used to nominate potential intervention strategies and steps to guide the design and implementation of community-based screening for AF.

RESULTS: A total of 28 factors from 21 studies were mapped into the COM-B model. Based on the BCW approach, 24 intervention strategies and 7 steps that could guide the design and implementation of community-based screening for AF were recommended.

CONCLUSION: The application of the COM-B model demonstrated how factors influencing the participation of individuals with undiagnosed AF in community-based screening could be identified. The model could also serve as a guide for the design and implementation of interventions for improving AF detection in the general population.

KEYWORDS: Atrial fibrillation, awareness, COM-B model, intervention design, screening, detection, stroke

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Background

Atrial fibrillation (AF) is the most common cardiac arrhythmia, with an estimated prevalence of 3% among adults aged 20 years and above.¹ The prevalence of diagnosed AF increases substantially with age; from 5.5% in those aged 65 years and above, to more than 15% in those older than 80 years.² AF has been associated with a 5 times increase in the risk of stroke and accounts for 30% of all ischaemic strokes.^{3,4}

AF can be asymptomatic and remains undiagnosed in about 30% of people with AF.⁵ This is of public health concern because asymptomatic AF, and even relatively brief AF episodes lasting for 24 hours (detected by implantable defibrillators), is associated with the same risk of stroke as symptomatic AF.^{6,7} In a UK study, stroke was found to be the first manifestation of AF in at least 2% to 5% of patients.⁸

People with undiagnosed asymptomatic AF can be identified through screening and may theoretically benefit from stroke-prevention medication.^{1,9} However, screening for undiagnosed AF, especially using electrocardiography (ECG), is not universally recommended. While the European

Society of Cardiology guidelines and other expert panels have recommended screening for AF (in people aged 65 years and above) based on yield and cost-effectiveness,^{1,10,11} the US Preventive Services Task Force and UK National Screening Committee have not made a recommendation on AF screening.^{12,13} More evidence from high-quality randomised clinical trials with outcomes on stroke and death rates of screen-detected AF is needed to demonstrate that AF detected through screening carries the same risk as clinically detected AF. These outcome studies are underway.¹⁴ Yet, if AF detection is limited to routine clinical practice, many people with asymptomatic AF may not be identified. For these people, the presence of AF would only be detected incidentally during a pulse check or an ECG for another condition.¹⁵ Evidence from a cluster-randomised controlled trial has shown that active screening (opportunistic and systematic) can identify 0.59% additional cases of undiagnosed AF per annum over routine practice.¹⁶ Hence, widespread screening could be implemented to substantially improve the detection rate for AF in the general population.



One of the major factors affecting the success and cost-effectiveness of community-based screening is the participation rate of the target group.^{17,18} The lower the screening uptake, the less likely the programme will be effective.¹⁸ A low participation rate of people with undiagnosed AF has been widely reported as a limitation of many community-based screening studies, with only half of the target participants approached actually taking part in the programmes.^{16,19–23} Therefore, there is a need to improve participation in community AF screening programmes by the target population, and to achieve this, the design of interventions to enhance AF detection should consider behaviour change processes, directed at improving participation in screening.

The UK Medical Research Council (MRC) guideline recommends that appropriate evidence and theory should be identified to guide the development of interventions so as to increase the likelihood of their success.²⁴ Therefore, the development of interventions to improve AF detection should be underpinned by relevant conceptual models of behaviour change. However, we are not aware of any AF screening programme developed based on behaviour change models. This may be a major reason why many screening studies have reported a lower-than-expected participation.

The Capability, Opportunity, and Motivation Behaviour (COM-B) model is a comprehensive model developed by Michie et al²⁵ to guide understanding of the behaviour of interest and identify behaviour targets as the basis for the design of interventions. The model postulates that for a person to participate in a particular behaviour (B), the individual needs to be physically and psychologically capable (C) to use social and physical opportunities (O) via motivators (M) that are reflective or automatic.²⁶ The Capability, Opportunity, and Motivation are collectively called 'components'. The model explains the interaction between these components, provides a guide to understand why a particular behaviour is not engaged in, and how behavioural targets can be identified and used as a focus for interventions.

The COM-B model also forms the basis of a larger system of behaviours called the Behaviour Change Wheel (BCW).²⁷ The BCW guides developers in the selection of intervention strategies and policy categories aimed at addressing what needs to be targeted in one or more of the components of the COM-B model to achieve a change in behaviour.²⁷ The COM-B model has been applied successfully in areas such as medication adherence,²⁸ the delivery of the Healthy Kids Check,²⁹ and adult auditory rehabilitation.²⁶ Similarly, the BCW has been used in areas such as promoting attentive eating³⁰ and condom use.³¹

In this study, the behaviour of interest was the participation of people with undiagnosed AF in community-based screening for AF (including the use of a device for self-screening). We therefore applied the COM-B model to (1) describe factors that could improve participation of individuals with

undiagnosed AF in community-based screening and (2) inform the design and implementation of interventions for improving AF detection in the general population.

Methods

The application of the COM-B model involved 4 steps: (1) literature review to identify factors associated with participation in community-based screening for AF, (2) behavioural diagnosis, (3) validation of the model by an expert panel, and (4) intervention strategy selection.

Literature review

A review of the literature was conducted to identify factors that could potentially be influenced to improve the participation of people with undiagnosed AF in community-based screening. A search of the literature was conducted using 4 electronic databases; Medline via PubMed, EMBASE via Ovid, Cumulative Index to the Nursing and Allied Health Literature (CINAHL; EbscoHost), and Scopus. Other relevant articles were identified by a manual search of the reference lists of included articles. Searches were performed using specified search strategies for each of the selected databases (Supplemental Appendix A).

Peer-reviewed studies written in English from the inception of the databases to February 2018 were eligible for inclusion based on the following criteria: (1) community-based mass screening for AF in previously undiagnosed individuals, (2) educational intervention or awareness campaign to improve AF awareness in the general population, and (3) AF knowledge of the general population. Only studies conducted in community settings (including primary health centres and general medical practices) were included in the review. Studies conducted in hospitals were excluded.

Behavioural diagnosis

The behavioural diagnosis was performed to find out what would need to change in terms of Capability (physical and psychological), Opportunity (physical and social), and Motivation (reflective and automatic) in people with undiagnosed AF to improve participation in screening for the condition. The process involved generating a list of factors extracted from the included studies (Table 1). The primary author mapped the factors onto subcomponents of the COM-B model based on relevance. The other 5 investigators then reviewed the mapped factors in the draft model.

Validation of the model

To ensure the relevance of each factor under components and subcomponents of the COM-B model, the list of factors was presented to an expert panel consisting of 3 cardiologists, a health educator, and 2 pharmacists, all with experience in AF

Table 1. A conceptual framework for improving AF detection in the community.

CAPABILITY	OPPORTUNITY	MOTIVATION
<i>Individual's psychological and physical capacity to engage in the activity concerned²⁵</i>	<i>All the factors that lie outside the individual that make the behaviour possible or prompt it²⁵</i>	<i>All the brain processes that energise and direct behaviour²⁵</i>
PSYCHOLOGICAL	PHYSICAL	REFLECTIVE
Capacity to engage in the necessary thought ²⁵	The opportunity offered by the environment ²⁵	Evaluation and plans ²⁵
<ul style="list-style-type: none"> • Knowledge about AF^{23,32-34} • Understanding the relevance of screening³⁴ • Educational level²³ • Cognitive function²³ • Confidence^{32,34} • Capacity to plan for responding to AF symptoms³² 	<ul style="list-style-type: none"> • Availability of screening programmes for AF²¹ • Availability of staff to perform screening at primary-care setting³⁵ • New technology for AF screening^{34,36} • Availability of funding³⁷ • Availability of time to conduct screening³⁵ • Availability of home visit screening³⁸ 	<ul style="list-style-type: none"> • Perceived benefits of AF screening³⁶ • Perception of AF screening³⁶ • Beliefs about AF and seeking treatment³² • Fear of involvement in research³⁶ • Fear of being screened positive for AF³⁶
PHYSICAL	SOCIAL	AUTOMATIC
Capacity to engage in the necessary physical process ²⁵	The cultural milieu that directs the way we think about things ²⁵	Emotions and impulses arising from associative learning and/or innate dispositions ²⁵
<ul style="list-style-type: none"> • Ability to attend for screening¹¹ • Capacity to undertake screening activities at primary care³⁵ • Age³² 	<ul style="list-style-type: none"> • Place of living²³ • Living with someone with AF³⁹ • Race²⁰ • Sex³² • Awareness campaign/educational-based programmes on AF^{21,40} • Number of GP visits²³ 	<ul style="list-style-type: none"> • Interest in AF screening³⁶ • Provision of incentives to GPs and pharmacies³⁷

Abbreviations: AF, atrial fibrillation; GP, General Practitioner.

and health behaviour research. The panel members were asked to independently assign the factors for relevance to be included in each component and subcomponent of the draft model using the definitions listed in Table 1. The primary author then compared the responses and resolved discrepancies by discussion. The draft model mapped by the panel was then compared with the one earlier assigned by the primary author to develop a draft model of the mapped factors. The draft model was further reviewed by the investigators to produce the final model (Table 1).

Intervention strategy selection

According to Michie's BCW approach, interventions should be targeted at factors that can be influenced in terms of 'Capability', 'Opportunity', and 'Motivation' for the behaviour of interest to be achieved.²⁵ From the review of the included studies, various gaps related to these factors were identified, and the corresponding potential intervention strategies were recommended (Table 2).

To ensure the relevance of the identified gaps and the recommended interventions, we presented the draft model to the same panel of experts for face validation. They were asked to review the model, particularly the gaps and interventions for appropriateness and relevance in clinical practice and public health programmes. The draft model was revised based on the feedback received (Figure 1).

Results and Discussion

Twenty-one articles were found eligible and included for review in this study. Thirty-two factors were found to be related to participation in community-based screening. Four factors were removed after further review by the investigators, while 28 factors were observed to be relevant and mapped onto the components of the COM-B model. In the validation stage, all the factors were observed to be relevant and mapped onto the model (Table 1). In the following section, we explain how the COM-B model was applied to describe these factors and the BCW to guide the design and implementation of community-based screening for AF.

Applying the COM-B Model to Describe Factors that Could Improve the Participation of Individuals With Undiagnosed AF in Community-Based Screening

Capability (psychological and physical): factors related to 'psychological capability', such as knowledge and understanding of AF, level of education, cognitive function, and capacity to plan for responding to AF symptoms, may influence an individual to participate in AF screening.^{23,32-36} However, further research is needed to confirm these findings. Factors mapped under physical capability were age, difficulties in getting to a screening venue, and learning to use devices for self-screening.^{11,32,38} Physical difficulties in the form of immobility, hearing and vision impairment may be a potential barrier to

Table 2. Intervention targets and strategies.

COM-B	INTERVENTION TARGETS	INTERVENTION STRATEGIES
CAPABILITY		TRAINING, EDUCATION, AND ENABLEMENT
Psychological	<ul style="list-style-type: none"> Lack of AF knowledge in the general population (based on limited studies on AF knowledge) Inadequate public campaigns on improving AF awareness The absence of theoretical evidence to guide educational interventions Limited data on AF awareness among health care professionals Inadequate information on the impact of educational interventions Conducting educational intervention without prior assessment of baseline AF knowledge Nonconsideration of reading level and involvement of a psychometrician while designing AF-specific instruments, for example, educational materials and knowledge assessment scales 	<ul style="list-style-type: none"> AF knowledge assessment particularly in a population with low health literacy and low-resource settings Considering people with low level of education and health literacy in the design of educational intervention materials Educational programmes on AF detection, symptom identification, prevention, and management Designing and implementing AF educational intervention and screening based on theoretical models Considering psychological and other sociodemographic factors while designing AF studies, including study tools Provision of AF awareness-raising campaigns Inclusion of AF awareness in other public health campaigns in the community
Physical	<ul style="list-style-type: none"> Difficulties in learning and using devices for self-screening Problems getting to screening settings by older and disabled people 	<ul style="list-style-type: none"> Training people, especially those with a physical disability, on how to use devices or check pulse for self-screening for AF
OPPORTUNITY		ENVIRONMENTAL RESTRUCTURING AND ENABLEMENT
Physical	<ul style="list-style-type: none"> Noninvolvement of AF in other public health-related programmes Inadequate community-based screening programmes Limited screening devices for AF self-screening Inadequate funding to implement community-based screening for AF The low rate of AF detection during routine clinical practice Inadequate staff and facilities to perform AF screening at primary health care centres and pharmacies Lack of time by health care professionals to conduct AF screening at primary health care centres and pharmacies 	<ul style="list-style-type: none"> Home-visit screening or transporting people with disability to screening venues Implementing community-based screening for AF in the general population Providing funds for implementing community-based screening for AF Improving the availability of hand-held devices for AF self-screening Streamlining screening programmes to an existing health care infrastructure for sustainability Evaluating AF educational interventions to ensure effectiveness and sustainability Integrating AF screening with other public health programmes such as vaccination and screening programmes for other diseases Studies are needed to investigate the knowledge, attitude, and perception of health care professionals on AF awareness and detection in clinical settings
Social	<ul style="list-style-type: none"> The lack of AF educational interventions in rural areas Limited data on determinants of AF knowledge and detection 	<ul style="list-style-type: none"> Conducting community-based AF screening in multiple venues/settings and remote areas
MOTIVATION		INCENTIVISATION, MODELLING, AND PERSUASION
Reflective	<ul style="list-style-type: none"> Limited qualitative studies exploring the experience of participants screened positive for AF following community-based screening 	<ul style="list-style-type: none"> Implementing AF awareness campaign/educational-based programmes on AF Making AF community-based screening free of charge Exploring social and psychological impacts of AF on participants with positive AF detection outcome following a screening programme
Automatic	<ul style="list-style-type: none"> Lack of mechanism and incentives for AF screening through GPs and community pharmacies for sustainability Lack of community engagement before implementing community-based screening and educational programmes for AF 	<ul style="list-style-type: none"> Screening for AF as part of routine annual medical examination by GPs Incentivising AF screening through GPs and community pharmacies for sustainability Giving rewards for participating in AF screening Using a participant as a role model to share a success story in print or electronic media regarding participation in AF screening, for other people to aspire or imitate Advertisement for AF screening via community-based organisations/clubs and print and electronic media

Abbreviations: AF, atrial fibrillation; COM-B, Capability, Opportunity, and Motivation Behaviour; GP, General Practitioner.

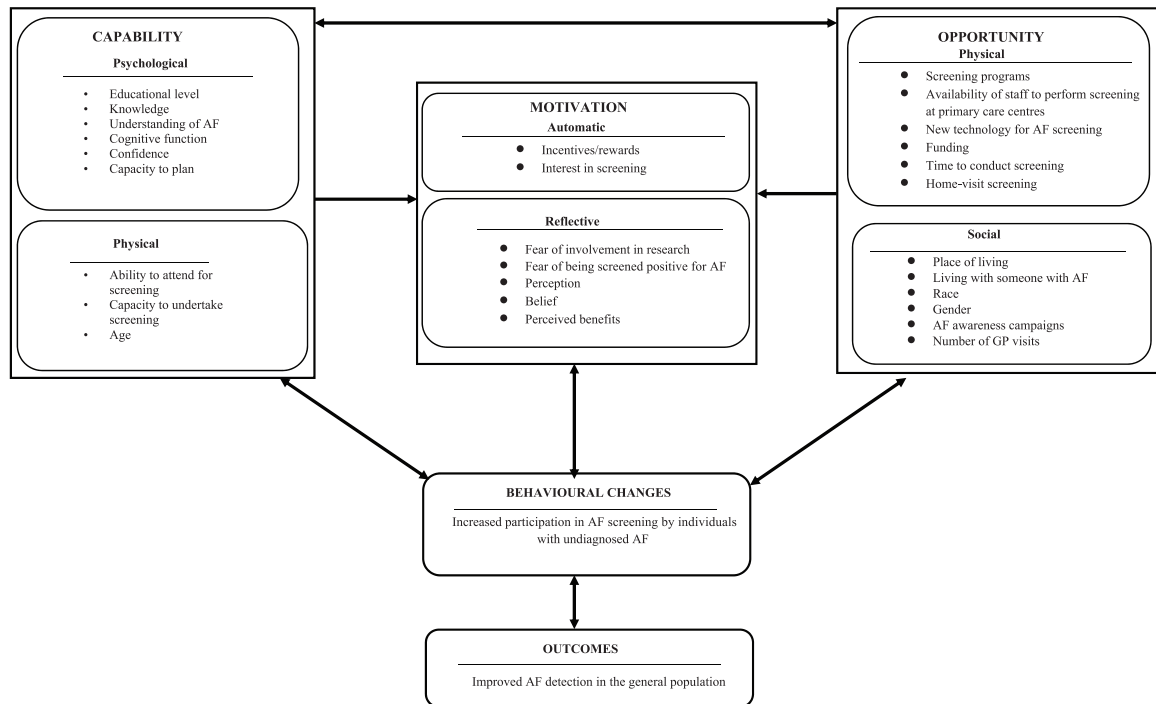


Figure 1. Application of the COM-B model and BCW to improve AF detection in the general population. AF indicates atrial fibrillation; BCW, Behaviour Change Wheel; COM-B, Capability, Opportunity, and Motivation Behaviour.

participation in screening programmes and accessing AF information.

Opportunity (physical and social): factors related to ‘physical opportunity’, such as the screening programmes at public centres,^{21,41} community pharmacies,¹⁵ primary health centres,^{34,35} individual’s homes,⁴³ and in low-resource settings,⁴³ were found to improve AF detection in the general population. Another factor is the advent of new technologies and devices for AF screening that are simple to use, inexpensive, and sensitive in detecting AF. This technology advancement has improved the feasibility and cost-effectiveness of community-based screening in the general population.^{15,36,43,44} In addition, the simplicity of the new technology has been shown to increase individuals’ participation in self-screening for AF.⁴²

Factors related to ‘social opportunity’, such as the unavailability of AF awareness materials and educational interventions,^{21,40} living in a rural area and infrequent general practitioner (GP) visits,²³ were found to be associated with low awareness of AF. Thus, exposure to health-related information through health promotion programmes and communication with health care providers, which are more available in urban compared to rural areas, may improve individuals’ participation in AF screening. Similarly, living with someone who has AF may improve an individual’s AF awareness and interest to participate in screening.³⁹ Gender and race disparity were other factors found to be associated with AF knowledge and screening.^{20,32}

Motivation (reflective and automatic): factors related to ‘motivation’, such as perception and belief about AF,^{32,34} interest³⁴ incentives and perceived benefits of AF screening, may influence an individual with undiagnosed AF to

participate in AF screening.^{36,37} Other factors are the fear of involvement in research and the fear of being screened for AF.³⁶ Therefore, allaying these concerns should improve the participation of people with undiagnosed AF to participate in screening programmes in the community.

Based on the COM-B model, the ‘Capability’ and ‘Motivation’ of people with undiagnosed AF, and the ‘Opportunities’ available in the community may increase their participation in screening exercises, thus leading to improved AF detection. Figure 1 illustrates how the 3 components hypothetically interact with each other to influence behaviour change. Psychological capability can be enhanced by improving knowledge and understanding of AF, and confidence to participate in screening for AF (example, educational interventions on AF).²⁵ Physical capability can be achieved by improving physical skill development and training (example, training people on how to use a device for AF self-screening).²⁵ Physical and social opportunity can be achieved through increasing access and reducing barriers to participation in screening (example, home visits screening and availability of AF screening devices).²⁶ Reflective motivation can be improved by imparting AF knowledge and giving information about the consequences of undiagnosed AF and the benefits of screening (example, AF awareness campaigns).²⁸ Finally, automatic motivation can be achieved through repetitive behaviour (example, making AF part of annual medical examinations by GPs), imitative learning and modelling (example, watching someone else sharing success stories regarding participation in AF screening or using a device for self-screening).^{25,28}

Each of these components can influence an individual's participation in AF screening directly (represented by single-headed arrows in Figure 1). In addition, 'Capability' and 'Opportunity' can interact together, leading to behaviour change. For example, older or disabled people with difficulties in getting to screening venues (Capability) could be provided with transportation (Opportunity) to improve participation. In some cases, 'Capability' and 'Opportunity' might influence 'Motivation', leading to the behaviour change (represented by the double-headed arrow in Figure 1). For instance, having AF knowledge (Capability) and the availability of screening programmes or devices in the community (Opportunity) could influence an individual's belief and perception about AF (Motivation), leading to participation in screening. The overall consequences of these behaviour changes could lead to improved AF detection in the general population.

Intervention strategy selection

Twenty-one gaps that could be targeted to improve participation in screening were identified in the Capability, Opportunity, and Motivation components of the COM-B model. Based on the BCW approach, 24 corresponding intervention strategies were recommended (Table 2). The panel of experts rated all the recommended interventions relevant and appropriate.

Applying the BCW to Guide the Design and Implementation of Community-Based Screening Programmes

Little is known about the design and implementation of interventions to improve AF awareness and community-based screening according to conceptual frameworks. For a successful implementation of such interventions, the designers of interventions for improving AF awareness and community-based screening programmes could consider the following steps based on the theoretical model:²⁷

1. Behavioural target specification: Identify the precise goal of the intervention in terms of what behaviour to change and in whom. For example, improving AF detection by increasing participation rate of people with undiagnosed AF in community-based screening for AF.
2. Behavioural diagnosis: Identify factors associated with participation in screening within the target population (through reference to available literature) in terms of Capability, Opportunity, and Motivation. This is to determine gaps that could be targeted for intervention.
3. Intervention strategy selection: Use the behavioural diagnosis to guide the selection of the intervention functions (education, incentivisation, modelling, training, enablement, and persuasion) and choose intervention strategies based on available resources and the target population.

4. Implementation strategy selection: Select policy categories, such as AF guidelines, legislation, regulation, and health service provision, to support the selected intervention for implementation and sustainability.
5. Identification of specific behaviour change techniques: Engage a community-based multidisciplinary approach when designing and implementing the interventions. Depending on the available resources and personnel, the involvement of a cardiologist, community-health nurse, health educator, health psychologist, health literacy, and health promotion expert would address the needs that may arise during the planning and implementation process and contribute to the overall success of the intervention.
6. Full intervention specification: Select settings for the screening/awareness campaigns based on country- and health care system-specific requirements and resources and link the screening to a pathway for appropriate diagnosis, management, and follow-up.¹⁰
7. Evaluation of intervention: Evaluate the impact of the intervention to support long-term implementation and sustainability.

In our study, the COM-B model was applied to describe factors that are associated with AF screening in the community. The model was used to explain how these factors could be influenced to improve an individual's participation in AF screening, potentially leading to early detection in the community. Finally, 7 steps were suggested based on the BCW to guide designers in the development and implementation of interventions for improving community-based screening for AF. The application of the COM-B model and BCW in this study is consistent with the guidelines of the UK National Institute for Health and Care Excellence and MRC Framework for the development and evaluation of interventions.^{24,45} Therefore, it could be postulated that interventions on improving AF detection based on the COM-B model and BCW may be more effective than the current approaches, with further research needed to test this hypothesis.

Limitations

We included only articles published in the English language; as such, relevant studies published in non-English language might have been missed. We did not include members of the general public and other relevant health professionals, such as nurses and health psychologists in the validation process. It is unknown if their views would be different from that which has been reported.

Conclusion

The application of the COM-B model demonstrated how factors influencing the participation of individuals with undiagnosed AF in community-based screening could be identified. The model could also serve as a basis for the design and

implementation of interventions for improving AF detection in the general population.

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Author Contributions

A.I.J, G.M.P, L.B., and B.C.W. contributed to the conception or design of the work. A.I.J. drafted the manuscript. All co-authors critically revised the manuscript. All authors contributed to the acquisition and interpretation of data and gave final approval and agreed to be accountable for all aspects of this work, ensuring integrity and accuracy.

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Supplemental Material

Supplemental material for this article is available online.

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