Pan-African Journal of Health And Psychological Sciences
ISSN: 3093-4737 | www.pajhps.org
Vol.2, No.11 | Jan–March 2026

The Behavioral and Naturopathic Diabetes Management Model for Men (BNDMM-M): A Holistic, Gender-Sensitive Approach to Type 2 Diabetes

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Abstract

Men living with Type 2 diabetes often encounter challenges that complicate long-term disease management, including limited engagement with healthcare, cultural norms around masculinity, and behavioural patterns that reduce adherence to lifestyle recommendations. While behaviour change theories have informed many diabetes interventions, they frequently fail to capture the holistic scope of naturopathic care and the gender-specific factors influencing how men manage chronic illness. Concurrently, naturopathy offers effective lifestyle strategies, including dietary modification, physical activity, mind–body practices, and stress management, yet these approaches often lack structured support for sustained motivation and adherence.

This article introduces the Behavioral and Naturopathic Diabetes Management Model for Men (BNDMM-M), a novel theoretical framework designed to address these gaps. The model integrates behavioural determinants such as motivation, perceived risk, and self-efficacy with naturopathic interventions and the social and emotional realities of men's lives. The BNDMM-M provides a holistic, gender-sensitive approach to diabetes care, emphasizing sustainable lifestyle change and self-management.

The framework offers practical insights for clinicians, public health practitioners, and educators, and underscores the need for future empirical research to validate and refine the model in clinical, community, and cultural settings. By bridging naturopathy, behavioural science, and gender-responsive care, the BNDMM-M advances the development of more effective interventions for men living with Type 2 diabetes.

Keywords: Type 2 diabetes, men's health, behaviour change, naturopathy, lifestyle interventions, gender-sensitive care, self-management, adherence, motivation, chronic disease management

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ISSN: 3093-4737

1. Introduction

Type 2 diabetes is one of the most widespread chronic conditions affecting adults across the world, and its prevalence continues to rise due to rapid urbanisation, sedentary lifestyles and changes in dietary patterns. Although the condition affects both men and women, research consistently shows that men face distinct challenges that place them at a higher risk of complications and poorer long-term outcomes. Men are often diagnosed at younger ages and with lower levels of obesity compared with women, suggesting a greater biological vulnerability and a higher likelihood of developing cardiometabolic complications earlier in life (Kautzky-Willer et al., 2016). These biological patterns are compounded by behavioural and psychosocial factors that shape how men recognise symptoms, seek help and manage chronic conditions such as diabetes.

Many men adopt behaviours that increase their risk of diabetes and make it harder to manage once diagnosed. These behaviours include limited engagement with healthcare services, delayed help-seeking, consumption of calorie-dense diets, low participation in structured physical activity and high levels of stress related to work and social expectations (Hankey et al., 2020). Cultural ideals of masculinity, such as independence, toughness and emotional control, often discourage men from acknowledging vulnerability or adopting long-term health behaviours that require support or accountability (Galdas et al., 2015). As a result, diabetes management strategies that do not consider gender-specific behaviours often fail to produce sustainable outcomes for men.

At the same time, holistic approaches such as naturopathy have become increasingly recognised for their potential to improve lifestyle-related conditions, including Type 2 diabetes. Naturopathic care emphasises diet quality, stress management, physical activity, herbal support and an overall sense of personal responsibility for health. These principles align well with the needs of individuals managing chronic disease, particularly when motivation and lifestyle change are central to long-term control (Sarris et al., 2019). However, although naturopathy offers valuable tools for diabetes management, it is often implemented without the behavioural structure needed to support sustained engagement, especially for men who may struggle with consistency and motivation over time.

Existing behaviour change theories provide important insight into how individuals adopt and maintain health behaviours. Models such as the Health Belief Model, the Transtheoretical Model, Social Cognitive Theory and Self-Determination Theory are widely used to guide interventions, yet they are not designed specifically for men with diabetes, nor do they fully incorporate the holistic practices central to naturopathic care. These theories often focus on cognitive processes such as perceived risk or readiness to change but do not fully address emotional, social or gender-related barriers that

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influence men's behaviour (Robertson et al., 2021). This creates a gap in practice, where neither behaviour change theory nor naturopathy alone provides a complete framework for addressing the complex needs of men with Type 2 diabetes.

To address this gap, this paper introduces the Behavioral and Naturopathic Diabetes Management Model for Men (BNDMM-M), a new theoretical framework that integrates behaviour change science, naturopathic principles and gender-sensitive insights. The purpose of this model is to offer a holistic and realistic approach to diabetes care that reflects the biological, behavioural and psychosocial experiences of men. The BNDMM-M explains how behavioural determinants interact with naturopathic interventions and with the gendered patterns that influence men's health decisions. By uniting these three domains, the model provides a foundation for designing interventions that support sustainable lifestyle change and better long-term outcomes for men living with Type 2 diabetes.

This introduction sets the stage for the development of the BNDMM-M by highlighting the need for integrated, holistic and gender-responsive frameworks in diabetes care. The following sections explore the background and rationale for the model, the methodology used in its development and the components that form the structure of the framework.

2. Background and Rationale

2.1 Men's Health Challenges in Diabetes

Type 2 diabetes affects men and women differently, with men experiencing higher rates of visceral fat accumulation, earlier onset of insulin resistance and a greater likelihood of cardiovascular complications (Magliano et al., 2019; Wang et al., 2021). Many men are diagnosed at younger ages and often present with poorer metabolic profiles at the time of diagnosis (Kautzky-Willer et al., 2016). This trend is linked not only to biological vulnerabilities but also to behavioural and social patterns that shape how men approach health and illness.

Men frequently engage less with primary healthcare and tend to seek medical support only when symptoms become severe (Galdas et al., 2015; Hale et al., 2020). Social norms around masculinity often promote stoicism, independence and reluctance to admit vulnerability, which leads to delayed diagnosis, poor adherence to treatment and limited involvement in preventive care (Connell & Messerschmidt, 2005; Springer & Mouzon, 2011). These factors are especially relevant in diabetes, where long-term management relies heavily on routine monitoring, dietary modifications, physical activity and emotional coping skills. Studies consistently show that men struggle more than women to sustain lifestyle changes, maintain medication routines and engage in structured self-management programs (Oliffe et al., 2019; Hankey et al., 2020).

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Because of these gendered patterns, diabetes management strategies that do not consider the lived realities of men often fail to support sustainable behavioural change. This reinforces the need for a model that accounts for masculine identity, social expectations and culturally embedded barriers to health-seeking.

2.2 Shortcomings of Existing Behavioural Theories

Behaviour change theories have been central to guiding diabetes interventions. The Health Belief Model, Social Cognitive Theory, the Transtheoretical Model, the Theory of Planned Behaviour and Self-Determination Theory each offer insight into motivations, perceptions and cognitive processes that influence behaviour (Glanz et al., 2015). These models explain how individuals weigh risks, build confidence and move through stages of change, and they remain widely used in health promotion.

However, there are notable limitations when these theories are applied to men with diabetes. First, most behaviour change models were developed without attention to gender-specific behavioural patterns (Robertson et al., 2021). They rarely account for masculinity norms that influence help-seeking, emotional expression and willingness to adopt long-term health behaviours (Gough & Robertson, 2017). Second, these models focus heavily on cognitive factors while paying less attention to cultural, emotional and environmental influences that are especially relevant in male populations.

Additionally, behaviour change theories typically emphasise psychological processes but do not integrate the physiological and holistic principles that underpin naturopathic approaches to diabetes management. For men who may rely more on autonomy, strength-based motivation and practical solutions, current behaviour change frameworks may not offer sufficient guidance for sustainable self-management.

2.3 Evidence for Naturopathic Approaches to Diabetes

Naturopathy offers a holistic approach to chronic disease management that aligns well with the lifestyle demands of Type 2 diabetes. It emphasises plant-based nutrition, stress reduction, physical activity, herbal support and mind–body practices that contribute to metabolic stability (Sarris et al., 2019; Bradley et al., 2021). Several studies show that naturopathic interventions can improve glycaemic control, reduce inflammation and enhance mental well-being in individuals with Type 2 diabetes (Oberg et al., 2015; Cooley et al., 2020).

Dietary counselling, mindfulness-based approaches and herbal therapies such as cinnamon, bitter melon and fenugreek have been associated with modest improvements in blood glucose regulation (Li et al., 2021; Ranasinghe et al., 2020). Stress-management modalities, including yoga, meditation and breathing techniques, have also been shown to support improved insulin sensitivity and reduced stress hormones (Hegde et al., 2022).

Despite this promise, naturopathic care often lacks behavioural scaffolding. Many men may

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appreciate the practical, hands-on strategies of naturopathy but struggle to maintain these practices without structured behavioural support. Integrating behaviour change science with naturopathic principles is therefore essential for long-term adherence.

2.4 Justification for a Combined Behavioural–Naturopathic Model

Men living with Type 2 diabetes face challenges that suggest neither behaviour change theory nor naturopathy alone provides an adequate framework for supporting sustainable lifestyle improvement. Behaviour change models are valuable for explaining motivation and cognitive processes, yet they often fail to incorporate holistic lifestyle practices. Conversely, naturopathy offers effective strategies for metabolic regulation and overall well-being, but it lacks clearly defined behavioural pathways to support adherence.

These limitations highlight the need for a combined model that provides men with realistic, structured guidance for change, integrates holistic naturopathic practices with evidence-based behavioural science, and addresses the gender-specific barriers influencing men's engagement with healthcare. The Behavioral and Naturopathic Diabetes Management Model for Men (BNDMM-M) was developed to meet this need. It draws on established behavioural constructs while embedding them within naturopathic principles and gender-sensitive insights. By uniting these approaches, the BNDMM-M offers a comprehensive framework aimed at enhancing self-care, sustaining motivation, and improving health outcomes among men living with Type 2 diabetes.

3. Methodological Approach to Model Development

The Behavioral and Naturopathic Diabetes Management Model for Men (BNDMM-M) was developed using a conceptual and integrative methodology, a common approach in theoretical research for generating new models by synthesizing evidence, combining insights from multiple disciplines, and identifying gaps in the literature (Walker & Avant, 2019; Jabareen, 2009). Given the study's aim of uniting behavioural science, naturopathic principles, and gender-sensitive insights, a flexible and iterative process was essential.

The model's development followed four stages: a comprehensive literature review, thematic synthesis, conceptual mapping, and iterative refinement. These steps ensured that the BNDMM-M reflects current evidence, maintains theoretical coherence, and remains practically relevant for men living with Type 2 diabetes.

The first stage involved a broad review of research on diabetes management, men's health, behaviour change theory, and naturopathic medicine. Databases including PubMed, CINAHL, Scopus, and Google Scholar were searched for peer-reviewed studies, systematic reviews, and conceptual papers published in the last two decades. This review clarified limitations in existing models and emphasized the need to integrate gender and holistic approaches into

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diabetes care (Glanz et al., 2015; Gough & Robertson, 2017; Sarris et al., 2019).

4. Presentation of the Behavioral and Naturopathic Diabetes Management Model for Men (BNDMM-M)

4.1 Overview of the Model

The Behavioral and Naturopathic Diabetes Management Model for Men (BNDMM-M) is a holistic, gender-responsive theoretical framework developed to support men living with Type 2 diabetes. The model integrates three central domains: behavioural determinants of self-management, naturopathic lifestyle interventions, and gender-related factors that influence how men perceive and respond to health challenges. It posits that sustainable diabetes management in men is achieved when behavioural readiness, holistic interventions, and considerations of masculine identity are aligned in a supportive and practical manner.

The model is grounded in evidence indicating that men benefit from structured, autonomy-supportive, and outcome-oriented approaches to lifestyle change (Galdas et al., 2015; Robertson et al., 2021). At the same time, holistic health strategies, including nutrition, physical activity, and mind-body practices, have been associated with improved glycaemic control and enhanced well-being (Oberg et al., 2015; Sarris et al., 2019). By combining these perspectives, the BNDMM-M provides a framework that acknowledges the complexity of men's experiences while offering realistic and actionable pathways for behaviour change.

4.2 Core Components of the Model

The Behavioral and Naturopathic Diabetes Management Model for Men (BNDMM-M) comprises three interconnected components, each playing a distinct role in shaping how men adopt, sustain, and benefit from diabetes management behaviours.

4.2.1 Behavioural Determinants

Behavioural determinants encompass the psychological and motivational factors that influence men's decisions regarding diabetes management. Key determinants include motivation and readiness for change, perceived risk and health beliefs, self-efficacy and confidence, and emotional coping and stress. Many men respond particularly well to goal-oriented, performance-focused approaches, especially when improvements in strength, energy, or physical functioning can be tracked. Understanding an individual's stage of readiness allows interventions to be tailored appropriately. Perceptions of risk also play a critical role, as men often underestimate the seriousness of diabetes when symptoms are not immediately visible. Confidence in the ability to make lifestyle changes strongly predicts sustained adherence, particularly in areas such as diet, exercise, and stress management. Emotional coping strategies are equally important, as unexpressed distress and chronic stress can undermine motivation and glycaemic control. These behavioural determinants interact dynamically and significantly influence the adoption of naturopathic practices.

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4.2.2 Naturopathic Interventions

Naturopathic principles emphasize the body's innate healing capacity, preventive care, and mind-body balance. Within the BNDMM-M, this holistic perspective is applied to support diabetes self-management in ways that appeal to men's preference for practical, actionable strategies. Core naturopathic elements include nutrition and dietary behaviour, physical activity, herbal and natural supports, and mind-body or stress-reduction practices. Whole-food nutrition, reduced refined carbohydrates, healthy fats, and plant-rich meals form the foundation of naturopathic diabetes care and have demonstrated metabolic benefits. Physical activity, including strength training, aerobic exercises, and functional fitness, resonates with many men while supporting glycaemic control and reinforcing masculine identity. Certain botanicals, such as cinnamon, fenugreek, and bitter melon, may safely support glucose regulation. Stress-reduction practices, including yoga, mindfulness, controlled breathing, and guided relaxation, have shown improvements in both glycaemic control and emotional well-being. Naturopathic interventions are most effective when paired with behaviour change techniques that foster consistency, accountability, and long-term adherence.

4.2.3 Gender-Sensitive Considerations

Gender significantly shapes men's health perspectives, motivations, and barriers. The BNDMM-M emphasizes the integration of masculine identity into diabetes care. Traditional masculinity norms, such as self-reliance, toughness, and control, can simultaneously motivate and inhibit health behaviours. For example, men may avoid seeking care to maintain an appearance of strength while embracing physical activity as a strength-affirming behaviour. Autonomy and personal responsibility are highly valued, making interventions that support independent decision-making more effective. Cultural identity and social roles further influence diet, exercise, and stress management, necessitating culturally responsive strategies that align with lived experiences. Men may also be reluctant to seek help or participate in support groups, highlighting the importance of solution-focused, confidential, and non-judgemental programs. By addressing these gender-specific factors, the model ensures that interventions resonate with men's values, identities, and social realities.

4.3 Interaction of Model Components

The BNDMM-M posits that sustainable lifestyle change emerges from the dynamic interplay among behavioural determinants, naturopathic practices, and gender influences. For instance, a man who identifies strongly with physical strength may be more motivated to engage in structured exercise, which enhances self-efficacy and supports improved glycaemic control. Similarly, stress-reduction practices can improve emotional coping, reduce glucose variability, and increase readiness for dietary changes. Framing naturopathic practices in ways that align with masculine identity, such as improving strength,

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control, or performance, further enhances adherence. Gender factors act as moderators, shaping risk perception, motivation, and willingness to engage with specific interventions. In this framework, behavioural determinants provide the motivational foundation, naturopathic interventions offer practical pathways, and gender-sensitive considerations ensure that strategies are culturally and personally relevant, thereby supporting sustained self-management and improved health outcomes in men with Type 2 diabetes.

4.4 Conceptual Representation of the Model

The conceptual structure of the BNDMM-M can be visualised as three interconnected domains that converge to influence diabetes outcomes. Behavioural determinants form the psychological core. Naturopathic interventions provide holistic tools and lifestyle practices. Gender-sensitive considerations shape how men engage with both sets of factors. When aligned, these domains lead to improved self-management, enhanced metabolic control and greater well-being.

Figure 1 offers a visual representation of the Behavioral and Naturopathic Diabetes Management Model for Men (BNDMM-M). It shows how the three main domains of the model work together to shape men's diabetes management. Behavioural determinants form the psychological foundation that influences how men think about and engage with self-care. Naturopathic approaches provide the practical lifestyle tools that support metabolic health and overall well-being. Gender-sensitive considerations influence how men respond to both behavioural and naturopathic strategies. As

shown in the figure, when these domains come together, they encourage the adoption of diabetes self-management behaviours, which then lead to improved health outcomes. These outcomes in turn help reinforce motivation and confidence, creating a positive feedback cycle that supports long-term change.

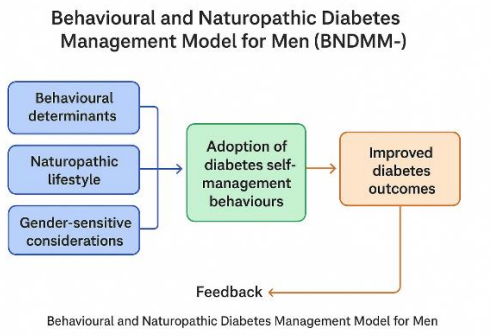

Figure: Behavioral and Naturopathic Diabetes Management Model for Men (BNDMM-M).

5. Discussion

The Behavioral and Naturopathic Diabetes Management Model for Men (BNDMM-M) integrates behavioural science, naturopathic principles, and gender-sensitive insights to provide a comprehensive framework for understanding how men manage Type 2 diabetes. The model addresses persistent challenges in diabetes care, including men's tendency to delay help-seeking, difficulty with lifestyle change, and low engagement with health services (Galdas et al., 2015; Hankey et al., 2020). By combining perspectives traditionally studied

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separately, the BNDMM-M reflects the lived experiences, motivations, and barriers that shape men's health behaviours, offering a more realistic and holistic approach to diabetes management.

5.1 Theoretical Contributions

The BNDMM-M advances theory in three key ways. First, it expands behaviour change models by embedding them within a gender-informed context. While traditional models emphasize cognitive processes such as perceived risk or self-efficacy, they often overlook the influence of masculinity on health behaviour (Gough & Robertson, 2017; Robertson et al., 2021). The BNDMM-M addresses this gap by acknowledging the role of identity, social expectations, and emotional expression in how men interpret and respond to diabetes-related challenges.

Second, the model strengthens the connection between behavioural science and naturopathic care. Naturopathic approaches emphasize lifestyle interventions but frequently lack structured behavioural pathways to support adherence. By linking behavioural determinants—such as motivation, readiness, and confidence—to naturopathic practices, the BNDMM-M offers an integrated structure better suited for sustained diabetes management.

Third, the model introduces a dynamic feedback loop in which improved diabetes outcomes reinforce motivation, self-efficacy, and ongoing engagement. This cyclical process aligns with evidence showing that experiences of success enhance commitment and support long-term behaviour change (Ryan & Deci, 2017).

5.2 Implications for Clinical Practice

The BNDMM-M provides practical guidance for clinicians working with men. It underscores the importance of direct, strength-based, and autonomy-supportive approaches, reflecting how many men prefer to engage with health information. Clinicians can use the behavioural component of the model to assess readiness for change, emotional coping patterns, and confidence in self-management. These assessments can then inform the introduction of naturopathic interventions, including dietary strategies, herbal supports, and mind-body practices.

Framing lifestyle changes in terms of performance, strength, control, or problem-solving can align interventions with masculine identity, enhancing engagement and adherence (Oliffe et al., 2019). Clinicians are also encouraged to address stress management openly, recognizing that stress and emotional suppression significantly affect glycaemic control.

5.3 Implications for Naturopathic Practice

For naturopathic practitioners, the BNDMM-M offers a structured approach to integrating behavioural guidance into holistic care. Practitioners can establish clear pathways and expectations for lifestyle change, set achievable goals, reinforce autonomy, and tailor strategies according to behavioural readiness. Understanding masculine norms and their influence on motivation allows interventions to

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be delivered in ways that are accessible, relevant, and respectful of men's lived experiences.

5.4 Implications for Public Health and Community Programs

The BNDMM-M also has broader relevance for public health and community-based initiatives. Many men remain underserved by conventional diabetes programs, and interventions informed by this model can be tailored to resonate with male values, such as family responsibility, physical performance, work productivity, and personal independence. Community programs can frame diabetes management as a means of enhancing strength, energy, and capability, while group-based approaches that are practical rather than emotionally focused may increase participation and engagement.

5.5 Strengths of the Model

A key strength of the BNDMM-M is its interdisciplinary approach, combining behavioural, naturopathic, and gender-sensitive perspectives to capture the multifaceted determinants of men's diabetes behaviours. The model is flexible, allowing adaptation to diverse cultural contexts, clinical environments, and individual preferences. Its feedback loop emphasizes that progress builds on itself, reflecting the real-world dynamics of behaviour change.

5.6 Limitations

Despite its strengths, the BNDMM-M is a conceptual framework that requires empirical validation. Future research should evaluate how effectively the model predicts behaviour, improves outcomes, and supports long-term adherence. Cultural modifications may be necessary, as experiences of masculinity and acceptance of naturopathic care vary across populations. Additionally, not all men will identify with the masculine norms described, highlighting the importance of considering individual differences in any application of the model.

6. Future Directions

The Behavioral and Naturopathic Diabetes Management Model for Men (BNDMM-M) opens several pathways for future research, clinical innovation and policy development. Since the model is conceptual, its next evolution depends on empirical validation and practical testing in real-world settings. These future directions will help determine how effectively the model captures the lived experiences of men and how well it supports meaningful improvements in diabetes management.

A key direction for future research is the empirical testing of the model's core components and pathways. Quantitative studies could explore the relationships between behavioural determinants, naturopathic lifestyle practices and gender-related influences, and how these predict diabetes self-management and metabolic outcomes. Mixed-methods research may be especially valuable, as qualitative insights can deepen understanding of men's motivations, identities and barriers to lifestyle change (Oliffe et al., 2019). These perspectives can help refine the model and improve its cultural sensitivity.

Another important step is to develop and test interventions grounded in the BNDMM-M. These interventions could combine structured

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behaviour change strategies with naturopathic practices such as nutrition counselling, physical activity coaching, stress-reduction approaches and herbal support. Pilot programs could assess whether men respond positively to interventions framed around autonomy, strength, practical problem-solving and performance—factors that align closely with masculine identity (Galdas et al., 2015; Robertson et al., 2021). Such programs would help clarify which elements of the model are most effective in motivating sustained behaviour.

Digital health tools also provide a promising avenue for applying the BNDMM-M. Mobile apps, telehealth coaching and online men's health platforms could deliver personalised behavioural guidance and naturopathic strategies while addressing privacy concerns that may discourage men from seeking face-to-face support. Digital tools can also incorporate feedback loops that visualise progress, reinforcing motivation and self-efficacy over time (Ryan & Deci, 2017).

Cross-cultural testing is another essential area of future work. Masculinity and cultural norms vary widely across regions and communities, and the relevance of certain behavioural or naturopathic components may differ depending on social context. Studies conducted in diverse cultural groups will help determine how the model should be adapted to ensure inclusivity and broad applicability.

Finally, future research could explore how the BNDMM-M informs policy and community health strategies. Many public health programs do not specifically address men's needs or preferences. By using insights from the model, policymakers could design outreach initiatives that resonate with men's identities and encourage earlier engagement with diabetes prevention and management services.

Overall, the future development of the BNDMM-M depends on collaborative research, clinical testing and adaptation across cultural and healthcare settings. These efforts will help establish the model as a practical and evidence-informed tool for improving diabetes outcomes among men.

7. Conclusion

The Behavioral and Naturopathic Diabetes Management Model for Men (BNDMM-M) offers a new way of understanding and supporting men who live with Type 2 diabetes. By bringing together behavioural science, naturopathic principles and gender-sensitive insights, the model responds to long-standing gaps in diabetes care, especially the need to recognise how masculine identity, motivation and lifestyle patterns influence health behaviour.

Men often face unique challenges in managing diabetes, including delays in seeking help, limited engagement with routine care and difficulty maintaining long-term lifestyle changes. The BNDMM-M addresses these challenges by highlighting the psychological, social and holistic factors that shape men's decisions and actions. It proposes that effective diabetes management is more likely when behavioural readiness, naturopathic lifestyle practices and gender-

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related influences are acknowledged and supported in an integrated way.

The model also emphasises the importance of a positive feedback cycle, where improvements in health reinforce motivation, confidence and continued engagement. This reflects the lived experience of many men, who often respond strongly to progress they can see and feel. The framework encourages clinicians, naturopathic practitioners and public health professionals to adopt approaches that are practical, strength-based and aligned with men's values and identities.

While the BNDMM-M provides a comprehensive conceptual structure, it now requires empirical testing and adaptation across diverse settings. Future research will help determine how well the model predicts behaviour, how it influences clinical outcomes and how it can be tailored to different cultural and community contexts. With continued refinement, the BNDMM-M has the potential to guide more meaningful interventions, support long-term change and contribute to better health and quality of life for men living with Type 2 diabetes.

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How to cite this article: Elliason, E.K (2026). **The Behavioral and Naturopathic Diabetes Management Model for Men (BNDMM-M): A Holistic, Gender-Sensitive Approach to Type 2 Diabetes. Pan-African Journal of Health and Psychological Sciences. Vol. 2. No. 1. Jan-March 2026.** **https://doi.org/10.64261/dhzahw51**