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Editorial

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Assessing alternative strategies for measuring metabolic risk

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Qiao et al. recently investigated the ability of dual-energy X-ray absorptiometry (DXA) scans and a smartphone app to provide detailed body composition and shape data. In a healthcare system that continues to rely on crude and stigmatizing measurements like body-mass index (BMI), their findings point to the potential of newer technologies to capture markers (i.e., visceral adiposity and fat distribution patterns) that provide clearer insights into metabolic health.

Visits to healthcare providers often begin with a familiar routine: patients slip off their shoes, step onto the scale, and healthcare staff swiftly capture weight and height measurements. This common practice allows healthcare providers to easily calculate BMI, the ratio of a patient's weight to height. BMI serves as an efficient risk-assessment tool for clinicians; values falling outside of the "healthy" range are associated with disease, including cancer, cardiovascular disease, and all-cause mortality[1]. Nonetheless, the use of this familiar tool is not without its flaws. Major shortcomings of BMI include its failure to distinguish body mass comprised of fat from muscle[2] and to account for differences in patterns of fat distribution[3] influenced by gender[4] and hormones[5]. Fat distribution in particular influences mortality risk[6], and visceral adiposity (fat surrounding the abdominal cavity) has been more closely linked to metabolic and cardiovascular syndromes than BMI[7–9].

Evidence in support of visceral adiposity as a major metabolic risk factor has prompted consideration of waist circumference, waist-to-hip ratio, and body roundness index as clinical proxies to assess metabolic health[10]. The importance of body composition in contributing to metabolic profile has also led to the study of new tools that measure body composition directly[11–13]. For example, Qiao et al.'s[14] recent study "Prediction of Total and Regional Body Composition from 3D Body Shape," investigates the use of DXA scans in providing detailed body composition metrics and three-dimensional (3D) body shape avatars. Building on findings from their DXA-based models, Qiao et al. further demonstrate the ability of a smartphone application to measure body shape and distribution patterns. As the healthcare system continues to rely on BMI to stratify metabolic risk, this study highlights the potential for recent technologies to offer detailed data on body composition and shape that BMI is unable to capture.

DXA scans and smartphone images provide details on body shape and composition

In their recent work, Qiao et al.[14] use silhouettes generated from DXA scans coupled with weight, height, and hip circumference measurements to generate a database of 17,461 3D mesh models. These models not only provide optimized images of 3D body shape but also predict body composition metrics, including percentage body fat, visceral adipose tissue mass, and abdominal subcutaneous adipose tissue mass. The high predictive value of these models demonstrates that 3D body shape and composition data can be derived from 2D DXA scans and that additional body measurements (i.e., weight, height, and hip circumference) can be coupled with 2D imaging to increase the accuracy of these tools.

Qiao et al.[14] also performed a validation study investigating a smartphone application that similarly produces 3D body shape models and body composition metrics using one DXA scan and four uploaded photos. This app is distinct from those studied previously in that it does not impose strict pose requirements for user photos, and it produces 3D body shape models in addition to body composition metrics. Given the growing evidence[15–17] supporting the associations between visceral adiposity and adverse health outcomes, this app appears to address the shortcomings of BMI by directly capturing the adiposity patterns most associated with the disease. Nonetheless, this app still relies on data from one DXA scan for each user in addition to four smartphone photos, limiting its efficiency and potential for immediate use in the clinic.

Furthermore, the focus of these tools on body shape raises additional concerns. Qiao et al.[14] argue that providing patients with 3D models of their bodies could prove motivating. Patients could use their 3D body shape avatars to track morphological changes over time and thereby directly visualize the effects of adhering to a healthy lifestyle. Nonetheless, while this emphasis on body shape could motivate some patients, shifting away from numerical measurements like BMI towards a focus on appearance-based models raises questions of whether these models could perpetuate weight-related bias in healthcare. Although abdominal adiposity is associated with adverse health outcomes, it is also linked to increased stigma among women[18]. Weight stigma is associated with worse physical and mental health outcomes[19], increased calorie consumption[20], avoidance of exercise[21], and weight gain[22]. Consequently, although these 3D body shape models deserve merit for revealing patterns of adiposity associated with disease, they also shift the focus of healthcare away from numerical data towards physical appearance and thus could perpetuate weight-related stigma[23].

Reflecting on the future of body composition metrics

The impact of weight on health status is undeniable; patients with greater body mass are at a significantly increased risk of cardiovascular disease[24], type II diabetes[25], certain cancers[26], and all-cause morality[27]. Healthcare providers thus have an imperative to discuss weight with patients and guide patients in decisions about lifestyle modifications and medications available to promote healthy body habits. The importance of adiposity, in particular, in shaping health, requires the use of clinical tools that can accurately assess adiposity to stratify patients into risk categories for metabolic disease. Still, current assessments of metabolic health within healthcare (such as BMI) rely on crude assessments of weight and height. Qiao et al.'s app represents a step towards developing a user-friendly solution to limitations current measurement tools pose by offering detailed body shape and composition data through analysis of four smartphone photos. Nonetheless, this app still requires at least one DXA scan to generate body composition data, and thus additional research and development is necessary before such an app can be considered for practical use in clinical care. Furthermore, while this app may raise concerns of weight stigma by focusing on body shape in addition to body composition metrics, body shape does influence health, and BMI is similarly linked to weight stigma[28]. Therefore, apps that provide body composition and shape data merit increased study to assess whether future iterations can efficiently address the shortcomings of current metabolic risk tools used in clinical healthcare.

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