# Use of artificial intelligence for real-time automatic quantification of left ventricular ejection fraction by a novel handheld ultrasound device

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## Background/Introduction

Transthoracic echocardiography is the most widely used imaging modality for the assessment of left ventricular ejection fraction (LVEF), which is crucial for patient care and management. Most recently, artificial intelligence (AI) has been employed to automatically identify LV endocardial boundaries and calculate LVEF. Technological advancements have enabled the development of small handheld ultrasound devices (HUDs) that can provide echocardiographic images at the point of care; however until now the HUDs have presented limited quantification capabilities. The application of AI algorithms to point-of-care echocardiography may facilitate the acquisition and accurate interpretation of a high volume of imaging data in real-time.

## Purpose

To evaluate the accuracy of a novel HUD with AI-assisted algorithm (autoEF) to automatically calculate LVEF.

## Methods

We prospectively included consecutive patients who were referred to a tertiary hospital echocardiography laboratory for a standard echocardiography examination. The modified biplane Simpson's method was used to determine LV volumes and function from the apical four-chamber and apical two-chamber views. All patients were subsequently scanned by the same observer with the Kosmos HUD (Echonous, Inc) and a fully automated estimation of the LVEF was possible after acquisition of the same two apical views within seconds by the device itself with the use of the AI-assisted autoEF algorithm **(Figure 1)**. The image quality for each examination was assessed and classified as good, moderate and poor.


**Figure 1**: Automatic quantification of LVEF by Kosmos autoEF AI-assisted algorithm

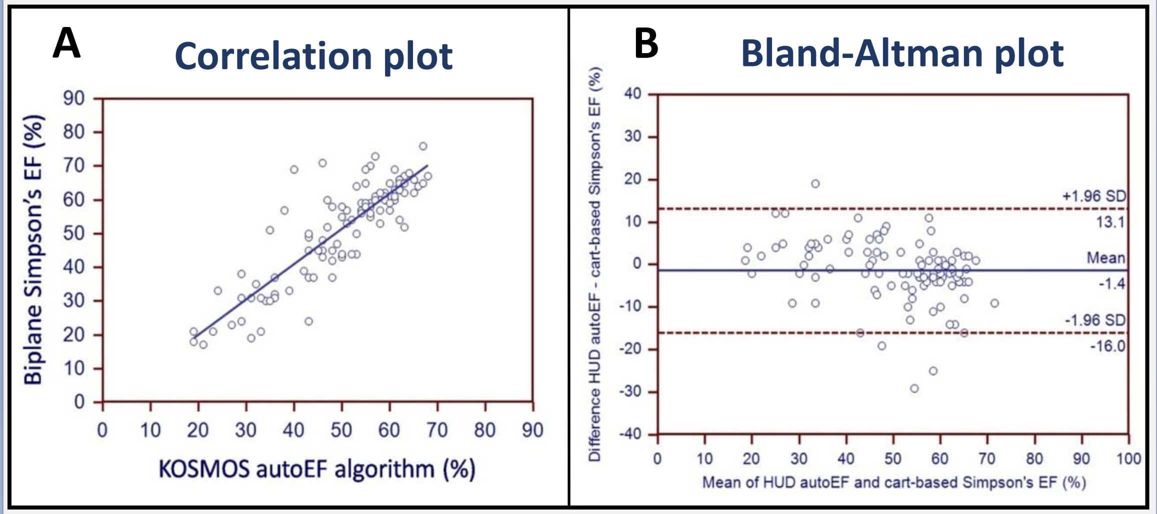


**Figure 2**: Linear regression (A) and Bland-Altman analysis (B) to assess agreement between Kosmos autoEF algorithm and the EF calculated by manual biplane Simpson's method

## Methods (continued)

The autoEF measurements were compared head-to-head with the manually traced biplane Simpson's rule measurements on cart-based systems as the reference standard, using linear regression and Bland-Altman analysis.

## Results

The study comprised 100 consecutive patients (57±15 years old, 61% male), including 38 patients with abnormal LVEF<50%. The image quality for the cart-based systems acquisition was assessed as good in 45%, moderate in 50% and poor in 5% of patients and for the HUD acquisition as good in 31%, moderate in 57% and poor in 12% of patients. AutoEF measurement by AI-assisted algorithm was feasible in all patients with LVEF measurements on cart-based systems. There was good agreement between the reference standard and Kosmos device autoEF algorithm with a correlation coefficient r=0.87, 95%CI 0.81-0.91, p<0.001, **(Figure 2A)**. The corresponding Bland-Altman plot showed a small non-significant bias of -1.42% (p=0.058), with limits of agreement ±14.5% for the auto-EF algorithm **(Figure 2B)**. The paired comparison of the LVEF calculation by the 2 methods did not reveal a significant difference between reference standard and HUD autoEF algorithm [56% (IQR 40% - 62%) vs. 53% (IQR 43% - 59%) respectively, p=0.106].

## Conclusion

The AI-assisted autoEF algorithm in a novel HUD can accurately calculate LVEF in real-time as compared to the recommended manual biplane Simpson's method on cart-based systems in an "all-comers" patient population.