

**Supplementary Material 5:** Synthesis of mean absolute percent error (MAPE) and mean percent error (MPE) values for waist-worn step counting devices stratified by internal mechanism (piezoelectric versus spring-levered).

**5.1) Summary of MAPE and MPE values reported for waist-worn step counting devices in treadmill-based validation studies by device mechanism.**

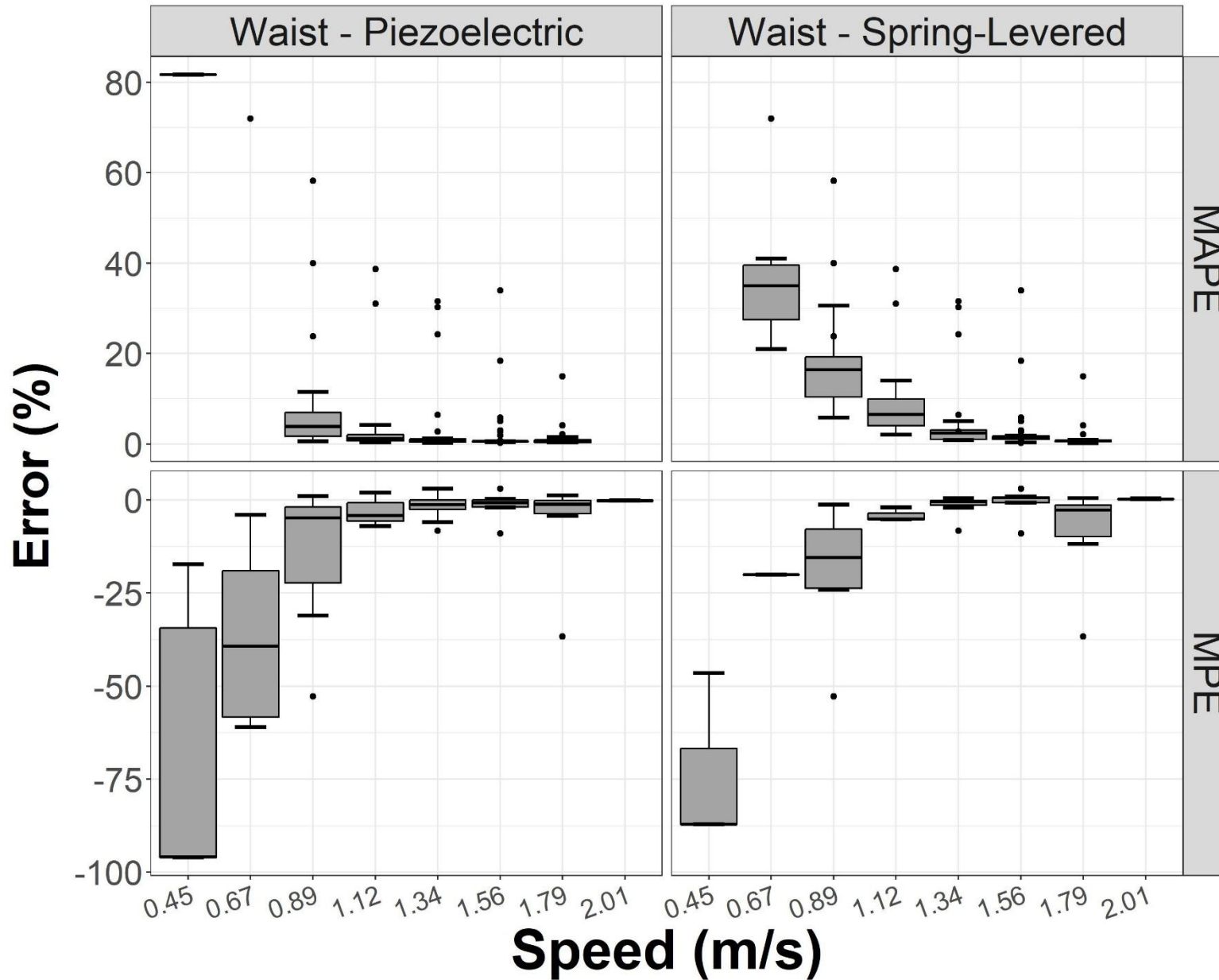
Error Measure & Mechanism	Value	0.45 m/s (1.0mph)	0.67 m/s (1.5 mph)	0.89 m/s (2.0 mph)	1.12 m/s (2.5 mph)	1.34 m/s (3.0 mph)	1.56 m/s (3.5 mph)	1.79 m/s (4.0 mph)	2.01 m/s (4.5 mph)
<b>MAPE</b> <i>Piezo-electric</i>	<b>M</b>	81.7*	--	3.8	1.2	0.5	0.5	0.6	--
	<b>Q1;Q3</b>			1.7 ; 6.9	0.6 ; 2.1	0.4 ; 1.1	0.4 ; 0.5	0.3 ; 0.9	
	<b>Sample</b> <sup>†</sup>	20 [1]	0	191 [11]	171 [10]	191 [11]	191 [11]	171 [10]	0
	<b>M</b>	--	35	16.4	6.5	2.4	1.3	0.6	--
<i>Spring-Lever</i>	<b>Q1;Q3</b>		27.5 ; 39.5	10.3 ; 19.2	4.0 ; 10.0	1.0 ; 3.1	1 ; 1.7	0.5 ; 0.8	
	<b>Sample</b> <sup>†</sup>	0	60 [9]	131 [19]	131 [18]	140 [20]	91 [17]	71 [9]	0
	<b>M</b>	-96.0	-39.3	-4.8	-4.1	-1.2	-0.8	-1.1	-0.2
	<b>Q1;Q3</b>	-96.0 ; -34.3	-58.3 ; -19	-22.2 ; -1.8	-5.6 ; -0.7	-2.5 ; 0	-1.9 ; 0.0	-3.7 ; -0.1	-0.2 ; -0.2
<b>MPE</b> <i>Piezo-electric</i>	<b>Sample</b> <sup>†</sup>	14 [4]	109 [5]	144 [13]	201 [6]	219 [14]	244 [8]	94 [8]	43 [2]
	<b>M</b>	-87.1	-20.1*	-15.5	-5.1	-0.4	0.6	-2.7	0.2
	<b>Q1;Q3</b>	-87.1 ; -66.8		-23.7 ; -7.8	-5.2 ; -3.5	-1.3 ; -0.1	-0.7 ; 0.8	-9.8 ; -1.3	0.2 ; 0.3
	<b>Sample</b> <sup>†</sup>	14 [2]	85 [1]	124 [7]	177 [2]	181 [6]	220 [4]	67 [4]	43 [2]

Abbreviations: MAPE = mean absolute percent error, MPE = mean percent error, M = median, Q1 = first quartile, Q3 = third quartile  
 Values of M, Q1, and Q3 are weighted by study sample size and their units are percent (%)

<sup>†</sup> Sample presented as: # person-bouts [# reported values]. Person-bouts represent (sample size)\*(bouts per participant testing a device at respective speed and wear location) summed across all studies. Reported values represent total numbers of MAPE or MPE values aggregated from individual studies for a device at respective speed and wear location

\* For speed-wear location combinations with only one reported value, only that value is presented

5.2) Tukey boxplots of MAPE and MPE values reported for waist-worn step counting devices in treadmill-based validation studies by device mechanism.



### 5.3) Table of waist-worn step counting devices for which MAPE and/or MPE values were reported, categorized by internal mechanism.

Device	Studies in Which Device was Tested
<b>Mechanism: Micro-Electromechanical Systems (MEMS)*</b>	
Samsung Galaxy S4 GT-I9500	Leong 2017
<b>Mechanism: Piezoelectric</b>	
Actical	Johnson 2015, Oliver 2011
ActiGraph 7164	Abel 2011, Le Masurier 2004
ActiGraph GT1M	Feito 2015, Brown 2013
ActiGraph GT1M (LFE)	Feito 2015
ActiGraph GT3X	Chow 2017, Feito 2015
ActiGraph GT3X (LFE)	Feito 2015
ActiGraph GT3X+	Hochsmann 2018
ActiPed	Brown 2013
activPAL	Kanoun 2009, Lutzner 2014, Oliver 2011, Ryan 2006, Maddocks 2010
Basis B1 Band	An 2017
Fitbit Charge	Chow 2017
Fitbit Charge HR	Tam and Cheung 2018
Fitbit Flex	Diaz 2016, Huang 2016, Chow 2017, An 2017
Fitbit One	Diaz 2016, Huang 2016, Chow 2017, Takacs 2014
Fitbit Zip	Beevi 2016, Huang 2016, An HS 2017
Garmin Vivofit	Huang 2016, An 2017
Garmin Vivofit 2	Hochsmann 2018
Jawbone UP24	Huang 2016, Chow 2017, An 2017
Mi Band 2	Tam and Cheung 2018
Misfit Shine	An 2017
New Lifestyles NL-1000	Abel 2011
New Lifestyles NL-2000	Duncan 2007
Nike+ Fuelband	Huang 2016
Nike+ FuelBand SE	An 2017
Omron HJ-112	Johnson 2015, Hasson 2009, Abel 2011
Omron HJ-321	Huang 2016
Omron HJ-720	Beevi 2016
PALlite	Maddocks 2010
Polar Loop	An 2017
SenseWear Armband Mini	An 2017
StepWatch 3	Feito 2015
Withings Pulse	An 2017
<b>Mechanism: Spring-Levered</b>	
Kellogg Special K step counter	Tudor-Locke 2006
Omron HJ-105	Le Masurier 2004
SportBrain iStep X1	Dueker 2012
Sportline 330	Le Masurier 2004
Sun TrekLINQ	Beets 2005
Walk4Life 2505	Beets 2005
Walk4Life Elite	Johnson 2015
Walk4Life Pro	Abel 2011
Yamax Digiwalker CW-700	Oliver 2011
Yamax Digiwalker CW-701	Huang 2016

Yamax Digiwalker SW-200	Beevi 2016, Duncan 2007, Johnson 2015, Beets 2005, Le Masurier 2004, Tudor-Locke 2006
Yamax Digiwalker SW-401	Brown 2013, Maddocks 2010
Yamax Digiwalker SW-701	Dueker 2012, Hasson 2009, Beets 2005, Abel 2011

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\*Error values for MEMs devices (i.e., the Samsung Galaxy S4) are not included in the summary table or boxplots above

## References for Supplemental File 5

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