

## POSTER SESSION 2

### Assessment of time in bed and overnight bed exits using bed based sensing

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Wallace et al. (2020). *Gerontechnology* 19(suppl); <https://doi.org/10.4017/gt.2020.19.s.70137>

**Purpose** Most Persons with Dementia (PWD) continue to live at home with family caregivers (Manuel et al., 2016). Previous work has shown the potential for supportive smart home systems to reduce the burden on caregivers (Knoefel et al., 2020; Wallace et al., 2018). However, a key challenge is accurate assessment of bed occupancy and exit (Klaffke & Staedt, 2006; Wickramashinge et al., 2017). The goal of this study is to compare alternative technologies. **Methods** 4 different bed sensors were deployed in a residential bed longitudinal study. These commercially available sensors include the Samsung SmartThings sensor (S) (Knoefel et al., 2020; Wallace et al., 2018) and three new sensor devices; Withings Sleep sensor (W), Emfit QS sensor (E) and BestBuy Assured Living bed sensor (B). A 55-year-old male and 50-year-old female tested the devices in the context of a double occupancy bed, each having their own sensor E, W and S, while the male also had a sensor B. A log was maintained for all bed entry and exit events to provide a ground truth reference. The sensors were integrated within smart home systems to provide automated reorientation queue lighting (Knoefel et al., 2020; Wallace et al., 2018) allowing the response times to be assessed. **Results and Discussion** This study has over 100 nights of data from each sensor. The results show the continued challenge in use of S as it did not work within the test bed and a work around using a floor mat deployment was used. W had errors associated with time in bed reporting (35.9%/13.9% error in time of entry/exit), missed out of bed short term exits (16.3%) and also reported 3 false positive exits. E bed entry/exit errors are 13.2%/20.9% with 59.2% short term exit events missed. B had 0%/3.2% bed entry/exit errors. Smart home integration testing showed all systems except E were able to turn on a smart home light within 10 seconds of bed exit, while E required 28 seconds. W also failed to turn on the light once in 10 tests. The different bed sensors had variable performance. W automatically determines the overnight period leading it to discard information outside this period resulting in it reporting shorter nights. E appears to confuse bed occupants when there is more than one also leading it to not detect exits by the associated person. Mat B appears to be the best alternative and its errors were associated with the position of the other bed occupant.

#### References

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Table 1 Bed entry/exit detection events.

	Actual nights	Entry error	Exit error	Actual overnight exists	Overnight exit error FN	Overnight exit error FP
<b>Withings</b>	231	83	32	522	85	3
<b>Emfit</b>	220	29	46	472	280	2
<b>BestBuy</b>	125	0	4	164	0	0
<b>Samsung</b>	198	40	52	487	95	0

Table 2. Sensor response time.

(seconds)	Samsung	BestBuy	Withings	Emfit
<b>Mean</b>	3.8	8.5	9.7	28.0
<b>std</b>	0.3	0.3	1.3	8.2