

Short Communication

Short term feasibility and efficacy of WetSense® - a bedwetting alarm device for incontinence

Hemavathi D.^{1*}, Jaya Das², Nelia³, Anindya Debnath², Deepak Prasad², Shaini Joice¹, Ruby Aleyamma Roy¹, Arvind Kasthuri³, Babu K. C.⁴, Akshay P.⁴, Lavanya Garady⁴

¹Department of Family Medicine, St John's Medical College, Bengaluru, Karnataka, India

²Department of PMR, St John's Medical College, Bengaluru, Karnataka, India

³Department of Paediatrics, St Johns Medical College, Bengaluru, Karnataka, India

⁴SKAN Research Trust, Bengaluru, Karnataka, India

Received: 12 October 2024

Revised: 07 December 2024

Accepted: 09 December 2024

*Correspondence:

Dr. Hemavathi D.,

E-mail: hema.dkp@gmail.com

Copyright: © the author(s), publisher and licensee Medip Academy. This is an open-access article distributed under the terms of the Creative Commons Attribution Non-Commercial License, which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.

ABSTRACT

There have been significant advances in detecting urine in pads and urine collection devices. In this pilot study, we tested a new wetness detection device for patients with incontinence. The aim and objective of the study was to test the efficacy of the device and to assess patient's and caregiver's satisfaction and to list the short-term adverse effects. Patients who had incontinence (urinary/faecal) and above 5 years, outpatient and inpatients of St John's hospital were selected and enrolled for the intervention after obtaining informed consent. Patient's general information and details about incontinence was recorded using a structured proforma. Patient and attendant were trained on the use of the device. After 3 days of use, feedback of the patient and the care giver was documented on effectiveness, adverse events, and satisfaction. The testing device was effective in testing the wetness. Patient and care giver were overall satisfied with the device for the ease of use. But the disadvantages were difficulty in cleaning and false alarm.

Keywords: Efficacy, Bed wetting device, Patient satisfaction, Care giver satisfaction

INTRODUCTION

Urinary incontinence is the loss of bladder control, leading to the involuntary leakage of urine. This condition can range from occasional minor leaks when coughing or sneezing to a complete inability to control urination. There are several types of urinary incontinence. Urinary incontinence can affect anyone, but it is more common in older adults and women. Based on definition of urinary incontinence, the prevalence is between 5% and 50% of adults.¹ It can result from various underlying conditions, including weakened pelvic floor muscles, certain medications, or neurological disorders. Urinary incontinence can significantly impact patients' lives, physical, emotional, and social well-being leading to poor self-rated health, lower quality of life, social isolation, and depression.^{2,3}

Traditional management of urinary incontinence is urine-absorbing aids like diapers and pads, as well as urine collection devices such as indwelling and condom catheters.⁴ However, none of these methods are ideal for patients or caregivers, and they come with significant drawbacks and side effects.

In the past two decades, there have been significant advances in detecting urine in pads and urine collection devices. Sensors in these pads can send alarm messages to caregivers for prompt diaper changes or alert a bed-wetting child for toilet training.⁶⁻⁹

In this pilot study, we tested a new wetness detection device for patients with incontinence. The device was attached to a mat placed under the patient. When the mat detected just 1 cm of wetness, a beep alarm would go off,

signalling the need for attention. The image of the Wetsense and sensor pad is given below (Figure 1 and 2).

Objectives

Objectives of the study were: to test the efficacy of the Wetsense®, a bedwetting alarm device; to assess the patient's and caregiver's satisfaction with the device; and to list any short-term adverse events with the usage of the device.

METHODS

Study design

It was an interventional descriptive study.

Study duration

The duration of the study was for 3 months, April 2023 to June 2023.

Inclusion criteria

Any patient with the history of incontinence (urinary or faecal), with age above 5 years were included.

Exclusion criteria

Patients with bedsores and skin problems - psoriasis, and eczema, and terminally ill patients - patients on life support and/or under palliative care were excluded.

Methodology

Patients who had incontinence (urinary/faecal) and above 5 years, outpatient and inpatients of St. John's Hospital were selected and enrolled for the intervention after obtaining informed consent. Patient's general information and details about incontinence was recorded using a structured proforma. Patient and attendant were trained on the use of the device. After 3 days of use, feedback of the

patient and the care giver was documented on effectiveness, adverse events, and satisfaction.

Statistical analysis

Data was entered in Microsoft excel sheet and results are expressed in frequencies and percentages.

RESULTS

The ten subjects recruited ranged between 7 to 95 years of age, with a mean age of 31.5 years. Among the adults three patients had spinal injuries, 2 had traumatic brain injury and 2 had other conditions leading to their incontinence. Two children aged 7 and 10 had nocturnal enuresis. Six subjects had both urinary and faecal incontinence and 4 had only urinary incontinence. None of them were on medication for incontinence and 9 subjects were using diapers (Table 1).

Patient satisfaction

The device successfully detected wetness in all 10 subjects (100% efficacy). There were no reports of adverse events such as skin allergies, bed sores, or urinary tract infections. 60% of patients were satisfied with the device. All patients found the device easy to use, beneficial, and helpful. However, one patient felt that cleaning and reusing the device was difficult. Three patients experienced discomfort due to continuous alarm even when there was no wetness. This could be due to a device fault, mat fault or due to improper cleaning of the mat, which require further investigation. Overall, all patients were satisfied with the device.

Caregiver satisfaction

All caregivers found the device easy to use, beneficial, and helpful. One caregiver reported difficulty with cleaning and reusing the device. Three caregivers experienced discomfort due to continuous alarms even when there was no wetness. Overall, all caregivers were satisfied with the device.

Table 1: Patient profile with efficacy, satisfaction, and adverse events.

S. no.	Age	Sex	Diagnosis	Duration of incontinence	Efficacy (detected wetness)	Satisfied	Adverse events
1	46	M	Traumatic brain injury	1 month	Yes	Yes	Nil
2	21	M	Spinal injury	4 months	Yes	Yes	Nil
3	21	M	Spinal injury	3 months	Yes	Yes	Nil
4	16	M	Spinal cord injury	8 months	Yes	Yes	Nil
5	32	M	Stroke in young	3 months	Yes	Yes	Nil
6	36	M	GB syndrome	4 months	Yes	Difficult to clean	Nil
7	30	M	Traumatic brain injury	1.5 months	Yes	Yes	Nil
8	95	M	Stoke/DM/HTN/post cancer recovery	1 year	Yes	Continuous alarm	Nil
9	7	M	Nocturnal enuresis		Yes	Continuous alarm	Nil
10	10	M	Nocturnal enuresis		Yes	Continuous alarm	Nil

Comments from patient and caregiver on the device

The common complaint from caregivers was that the device was cumbersome to use as it required an extra bed sheet and rubber sheet over the device. Patients could not lie directly on the device, necessitating cleaning the bed sheet, device, and rubber sheet each time they were soiled. One patient commented that while the device is a good idea, it needs improvement.

DISCUSSION

The main strategies for bladder accidents or incontinence in hospitals and homes include the use of diapers (43%), followed by external catheter drainage (34.6%), intermittent catheterization, and suprapubic catheterization. Diapers are commonly used because they are non-invasive and easy for healthcare workers and caregivers to use.

Absorbent materials like diapers and pads are the most expensive option, accounting for 63% of the total patient costs for managing urinary incontinence. The complications associated with diaper use include incontinence-associated dermatitis (ICD), pressure sores (PS), pain and discomfort, and worsening of urinary incontinence. Diaper use can also negatively impact self-esteem and increase the risk of hospital-acquired infections.

To prevent these complications, frequent diaper changes are recommended—at least once every 6 hours—and the use of occlusive moisturizers, which further adds to the cost and burden on caregivers.^{10,11}

Evolving technologies in treatment of UI

With the advent of moisture sensors both integrated and external and the alarm mechanisms has led to new management modalities for babies (wet diaper alarm system) and bed bound UI patients in health care facilities. Its use is also greatly utilised in toilet training for enuretic children. There is also development of Automatic urinary delivery system that automatically transports the urine into a separate urine storage container for later disposal. This has been used as nursing robots that can help solve the problem of caregiver shortage in the future in Japan.¹²

Challenges of new technologies

One of the most challenging aspects of a UI is to develop a solution that is both comfortable and discreet, allowing patients to wear it with ease, most of the devices were too large for a person to wear comfortably. Studies attempting to design a small and portable device, suitable for comfortable use, failed to propose a device with a rapid response time, decreased detection accuracy, leading to potential false alarms.¹³

CONCLUSION

The testing device proved effective in detecting wetness, and both patients and caregivers appreciated its ease of use. However, the device presented some drawbacks, including difficulty in cleaning and occasional false alarms. To address these issues, it is recommended to modify the design by incorporating a skin-friendly fabric for the mat, eliminating the need for an additional bedsheet. The device appears particularly suitable for adult patients undergoing continuous intermittent catheterization and for managing nocturnal enuresis in children. Additionally, it may offer a cost-effective alternative to diapers, though further research is needed to confirm this potential.

Funding: No funding sources

Conflict of interest: None declared

Ethical approval: Not required

REFERENCES

1. Litwin MS, Saigal CS. Urologic Diseases in America. US Department of Health and Human Services, Public Health Service, National Institutes of Health, National Institute of Diabetes and Digestive and Kidney Diseases. Washington, DC: US Government Printing Office. NIH Publication No. 07-5512. 2007;161.
2. Fantl JA, Newman DK, Colling J. Urinary incontinence in adults: acute and chronic management. Clinical Practice Guideline Number 2 (1996 Update). Rockville, MD: Agency for Health Care Policy and Research, 1996, AHCPR Publication No. 97-0682. 1996.
3. Melville JL, Delaney K, Newton K, Katon W. Incontinence Severity and Major Depression in Incontinent Women. *Obstet Gynecol*. 2005;106(3):585-92.
4. Cottenden A, Bliss D, Buckley B. Management using continence products. In: Abrams P, Cardozo L, Khoury S, editors. *Arnhem, The Netherlands: International Consultation on Urological Diseases and European Association of Urology*. 2013;1651-786.
5. Aquino PA, Melo RP, Lopes MVO, Pinheiro AKB. Analysis of the concept of technology in nursing according to the evolutionary method. *Acta Paul Enferm*. 2010;23(5):690-6.
6. Tinnion E, Jowitt F, Clarke-O'Neill S, et al. The further development of the active urine collection device: a novel continence management system. *Proc IMechE, Part H: J Engineering in Medicine* 2003;217(4):291-6.
7. Siden J, Koptioug A, Gulliksson M. The "smart" diaper moisture detection system. In: 2004 IEEE MTT-S international microwave symposium digest, Fort Worth. New York: IEEE. 2004;659-62.
8. Ang L, Ow S, Seng K. Wireless intelligent incontinence management system using smart diapers. In: 2008 5th international conference on

- electrical engineering/electronics, computer, telecommunications and information technology, Krabi, Thailand, 14–17 May 2008, paper no. 1. New York: IEEE. 2008;69-72.
9. Tanaka T, Miyagawa R, Ishitsuka Y. Automatic urine collection apparatus. Patent 7722584 B2, USA. 2010.
 10. Subak LL, Goode PS, Brubaker L, Kusek JW, Schembri M, Lukacz ES, et al. Urinary incontinence management costs are reduced following Burch or sling surgery for stress incontinence. *Am J Obstet Gynecol*. 2014;211(2):171-3.
 11. Cardoso GB, Silva ALA. O processo de trabalho na enfermagem: articulação das Tecnologias do Cuidado. *Rev Enferm UERJ*. 2010;18(3):451-5.
 12. Jeong G, Park S. Review of urinary continence care products using sensor technology to improve effectiveness. *Proc IMechE Part H: J Engineering in Med*. 2019;233(1):91-9.
 13. Ben Arous M, Haddar I, Truong A, Ayena JC, Ouakrim Y, El Kamel L, et al. Non-invasive wearable devices for urinary incontinence detection—a mini review. *Front Sensors*. 2023;4:1279158.

Cite this article as: Hemavathi D, Das J, Nelia, Debnath A, Prasad D, Joice S, et al. Short term feasibility and efficacy of WetSense® - a bedwetting alarm device for incontinence. *Int J Community Med Public Health* 2025;12:422-5.