Reviewer’s report

Title: Improving diaper design to address incontinence associated dermatitis

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Reviewer: Mandy Fader

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This paper describes three small studies to test whether an improved diaper construction results in better clinical and surrogate measures of skin health compared to a conventional diaper. It is good to see developmental work in this area of absorbency science and the authors show some encouraging results. However at the moment there are gaps in the rigour of reporting (see below) and these need to be addressed before publication – I would therefore consider them to be compulsory.

In general:
The paper is difficult to follow and I think would be greatly improved by describing the engineering of the diaper as the ‘intervention’ and then describing the methods used to test whether the improvements showed measurable differences.

In the first clinical study 12 patients with incontinence associated dermatitis (IAD) consented to have their skin health problems monitored and measured (using a rating scale) before and after the introduction of modified diapers to their long-term facility. The first laboratory experiment involved wetting diapers (? 3 modified, 3 conventional) with saline solution to 50% saturation and measuring pH on the surface of the different diapers. In the second quasi-clinical study patches (? number) of modified and conventional non-woven and backing films were strapped to the volar forearm of volunteers (? number, age, sex etc) for 4 hours and skin hydration was measured using a corneometer.

Abstract:
The abstract needs to be rewritten to clearly show the 3 parts to this study as outlined above. At the moment it is confusing and rather than describe the improved diaper properties in the methods, I think it would read better to state in the background that a diaper was engineered to be better for skin health and that this study aimed to test whether the diaper showed measurable differences to clinical and laboratory measures of skin health. It follows that the results need to clearly show the results from the 3 studies. The conclusion needs to be re-written based on the results (which were not about strengthening the epidermal barrier function).

Literature review/background – this is generally written well– line 2 need to put numbers on ‘quite a large number’. Third para line 4 – remove ‘it is important to realize that’. Para 4 line 5 As a result even minor external stress leads to
long-lasting inflammation – does it? This statement needs supportive references or needs removing. Same para – moderate tone of final sentence – ‘stressing the epidermal barrier to a maximum…‘. I was surprised that no reference was made to the body of work on baby diapers (published mainly in the 1980s) where improvements in skin health were the goal of modified diaper construction. It would also have been good to include a section on methods of measuring skin health, including the difficulties of doing so.

I think after ‘background’ comes the section on ‘development of skin-adapted incontinence product’ This section should show how the construction of the diaper would be expected to lead to improvements in: skin pH, skin hydration and skin health (currently in methods).

After this I would like to see the research question or aim of research – something like - The aim of this study was to test whether a modified diaper construction resulted in measured improvements in surrogate skin health markers (in the laboratory) and clinical skin health measurements (in patients).

Methods:
Development of the skin-adapted incontinence product – this section should come before the methods as indicated above.
Under this section the three methods of testing the diaper should be described – at the moment the diaper development is inter-woven into these experiments and the details of the experiments are insufficient.

The pH experiment – number of diapers used in each test needs to be clarified, plus the methods of soaking.

The breathability experiment – there is no information provided on the volunteers or the number of repeats.

The clinical ‘before and after’ test – no data is presented on who carried out the skin inspection nor the reliability or validity of the developed tool these need to be included.

Results:
This whole section is confusingly written and needs to be more systematically laid out as indicated above. There is too much discussion and opinion in this section and not enough focus on results.

Discussion:
Page 10 Para 1 line 7 – Contrary to common belief…. – this is an unsubstantiated statement – it should be removed or refs added. Pate 11 para 1 – remove word ‘huge’

A section on limitations should be included. There needs to be a discussion about limitations of all methods e.g. use of surrogate urine rather than saline for pH experiment; effect of breathable panels when most skin lesions occur within the absorbent area; use of before and after design and lack of control meaning
that results could be attributed to increased attention by nursing staff who were aware of new diapers.

Conclusion
This needs to be written with greater focus on the aims of the study and a more cautious tone. The first sentence is not supported by the data (the studies did not measure the strength of epidermal barrier function). The word ‘micion’ should this not be micuritions? The need for further clinical research in the form of a randomized controlled trial, to test the efficacy of the improved diaper should be included.

Tables:
Tables 1 and 2 – the Ns need to be added

I’m not sure about what Table 4 is showing – needs to show both the ‘before and after’ data.

**Level of interest:** An article whose findings are important to those with closely related research interests

**Quality of written English:** Acceptable

**Statistical review:** No, the manuscript does not need to be seen by a statistician.