

A low-tech innovation and its positive impact upon housekeeping in hotel staff

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The Duvetlifter is a low-tech bed-making tool that was developed to assist housekeeping staff so that beds in hotels could be changed with less physical stress for the hotels' employees. In this research, we investigate the effectiveness of the tool and learn about how it can improve operations and increase the quality of life of housekeeping staff. To learn about the tool's effectiveness and impact upon the employees, eight housekeeping staff members of a five-star Amsterdam hotel used the tool in their workplace and reported various aspects of occupational health and stress experienced. In addition, the employees were observed using the tool in their workplace. Finally, the executive housekeeper of the hotel was interviewed to learn about how they understand the tool had been effective in supporting the staff's tasks at work. The findings illustrate that the housekeeping staff experience substantial stress and health issues caused by their occupations. The findings also reveal that several of the employees reported the benefits that they experienced by using the tool and that they could make some suggestions to how to improve the tool in their occupational setting. However, in some ways the tool may increase stress and anxiety, as it takes somewhat longer to change a bed. The trade-off between employee well-being and efficiency is an issue management will have to contend with.

Keywords: *Low-tech, Innovation, Housekeeping, Hotels, Accommodation, Bed, Well-being*

1 INTRODUCTION

There is significant focus upon the integration of automation technologies in the hospitality and tourism industries in the academic literature (see, for example, Ivanov, Webster and Berezina, 2017; Ivanov et al., 2019; González-Santiago et al., 2024; Ivanov, Webster and Seyitoğlu, 2023; Webster and Ivanov, 2021; Koerten and Abbink, 2023), usually highlighting how robots, artificial intelligence (AI) and other automation technologies can be integrated into tourism and hospitality operations to improve services and make operations more efficient and cost-effective. However, there are technological innovations that are innovative but do not require high-tech solutions and software engineering, the types of innovations frequently overlooked in the literature.

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While some research has shown that technological innovation has a positive impact upon employment in the hospitality industry (Tian, 2024), innovation need not be high-tech in nature. In this analysis, we discuss a low-tech innovation and analyse its potential to improve hospitality operations.

Hospitality operations typically consist of a number of different departments, each of which contributes to the operational effectiveness of the organization's mission. One department that is seen as crucial, albeit a less-than-glamorous back of house operation, is Housekeeping. There is a substantial body of literature that focuses upon the needs for a strong Housekeeping workforce and management (see, for example, Zhang et al., 2024; Devrim Yilmaz, 2017; Kumar and Singh, 2015). This literature generally acknowledges the importance of the operations of housekeeping, the difficulty in motivating and retaining the workforce, and the issues that such a workforce has with occupational injuries.

One major issue that the housekeeping workforce faces is a number of ergonomic problems that undermine productivity and well-being of those on the housekeeping staff. There are many researchers who are concerned with the physical issues faced by housekeeping staff, for example Krause, Scherzer and Rugulies (2005) investigate the prevalence of pain amongst the housekeeping workforce. Their study identifies a great deal of physical pain and discomfort amongst the housekeeping staff surveyed in Las Vegas, while a separate study identified substantial lower back pain amongst Spanish hospitality workers (Zamorano García et al., 2024). The association between chronic pain and the work of housekeeping employees is not an anomaly and there are other studies that identify pain and discomfort in the workplace with the experiences of housekeeping workers (see, for example, Chela-Alvarez et al., 2022; Sánchez-Rodríguez et al., 2022). There are other studies that have investigated the concerning stress levels of housekeeping workers and the way that the work may have a deleterious impact upon the workforce's health and well-being (see, for example, Chela-Alvarez et al., 2021; Faulkner and Patiar, 1997; Sanon, 2013). Other studies are concerned with the general quality of the workplace for housekeeping employees (Hsieh et al., 2023; Shapoval et al., 2022; Eriksson and Li, 2009) or institutional barriers that may prevent organizations from improving conditions for housekeeping employees (Ambardar, Singh and Singh, 2023). At any rate, there is substantial evidence that ergonomic issues from the workplace lead to about a third of housekeeping employees using painkillers and antidepressants to cope with the pain and stress of housekeeping (Chela-Alvarez et al., 2022; Shapoval et al., 2022). The bulk of the literature indicates numerous well-being issues of housekeeping employees suffering from various physical and stress-related issues that are either caused by or exacerbated by their work; thus, it is imperative to identify ways that the physical and emotional stress of housekeeping can be ameliorated. There is also a literature devoted to innovations to improve the quality of life of housekeeping employees (see, for example, Harris-Adamson et al, 2019; Mejia, Ciarlante and Chheda, 2021).

While hotel guests can reasonably expect clean sheets on the bed when they check in, the workforce changing the beds will often experience physical pain, as well as the typical workplace stress found in any service environment. The changing of sheets and bedding is an important aspect of the guest experience and is one important aspect in the prevention of the spread of bedbugs, a recurring issue in hospitality (see, for example, Koganemaru and Miller, 2013). There may also be some reason to believe that the hard work of changing sheets results in housekeeping not actually changing the sheets in hotels, as there is evidence that housekeeping in some instances does not change the sheets (Inside Edition, 2020). Here we investigate the effectiveness of a low-tech solution to an ergonomic problem in the hospitality industry, the physically taxing changing of blanket covers to determine whether a low-tech solution can

improve performance and efficiency, while supporting a positive quality of life for the employee. Such research has been done before for other tools used to change beds (Harris-Adamson et al., 2019) in an effort to identify inexpensive low-tech solutions to the difficulties housekeeping workforces face and this research is part of that effort to identify practical low-tech solutions to improve the workplace for housekeeping employees. In the following sections, we explain the fieldwork process, discuss the findings and conclude illustrating what work must be done in the future to ensure that both high-tech and low-tech solutions contribute to better services and a better quality of life for the hospitality workforce.

2 METHODOLOGY AND FIELD WORK

This study employs a mixed-methods approach, mostly qualitative in nature but also with some quantitative data to evaluate the Duvetlifter, a low-tech bed-making tool, and its impact on the well-being of housekeeping employees. Figure 1 illustrates how the Duvetlifter technology works in assisting the task of changing the duvet cover. The Duvetlifter is a collapsible apparatus designed to lighten the task of changing a blanket cover. The tool is set up by setting the crossbar to the right width. Next, the changing of the cover is executed as per usual, with the housekeeper removing the used cover, depositing this in the laundry bin, unfolding a new cover and inserting the corners of the blanket

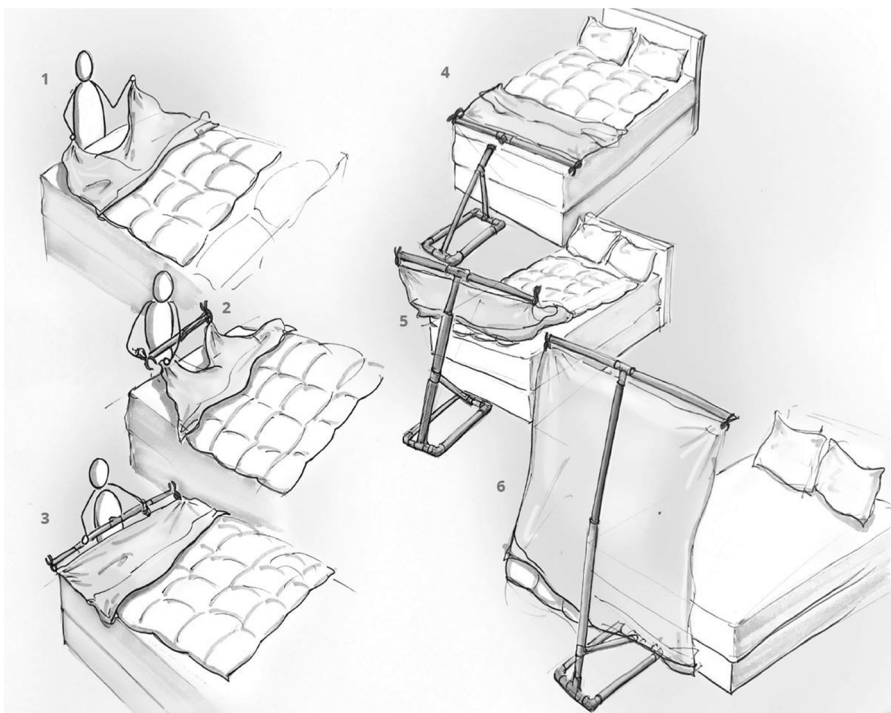


Figure 1 Schematic description of the working principle of the Duvetlifter

into the corners of the cover. Next, instead of the housekeeper taking the corners and shaking the cover to get the blanket in, the corners are clamped to the crossbar of the Duvetlifter, and the bar is lifted up. Assisted by gravity, the cover drapes over the suspended blanket. The Duvetlifter is then used to place the blanket on the bed without the need to reach over the bed. Finally, the Duvetlifter is unclamped and folded again, ready to be transported to the next room.

In total, there were multiple sources of data upon which the evaluation of the effectiveness of the Duvetlifter was done. Housekeeping staff were asked before and after using the tool to measure their health and well-being, based upon commonly used measures in the research (explained below) to learn about the impact of the tool on the well-being of the employees in housekeeping. In addition, a researcher observed housekeeping employees to learn about how the Duvetlifter was used in a practical/real workplace environment, taking note of mechanical, ergonomic and in-field praise or complaints about the tool. There is no standard tool for observations used in ergonomic research that is an accepted standard (Lowe, Dempsey and Jones, 2019), so a grounded approach was taken, gathering data from the observations based upon the specific environment in which the observations took place. Finally, the executive housekeeper in charge was asked about the tool from a managerial perspective, using a semi-structured questionnaire.

There were 8 housekeeping volunteers involved in using the Duvetlifter out of a total team of 24 in a five-star hotel in Amsterdam, the Netherlands, a hotel that is part of a major international chain. The volunteer participants were presented with an informed consent form explaining the goal as well as the information that they could opt out at any moment. The Duvetlifter was used during the hotel's normal operations, allowing the housekeepers to use the tool in their actual work environment. This approach ensured that the evaluation of the tool's effectiveness was grounded in practical, everyday scenarios rather than a contrived experimental setting. Each housekeeper was asked to use the Duvetlifter 10–12 times.

Data were gathered before the use of the Duvetlifter and after the participants' experience using the Duvetlifter. Before testing the tool, participants rated their level of pain, stress and anxiety, using a survey. They were also asked to indicate the areas of their body in which they experienced pain while working. Following the experience using the tool, the housekeepers completed a survey in which they rated their experience with the Duvetlifter on a 7-point Likert scale. The survey also explored the advantages and disadvantages of the Duvetlifter compared to traditional bed-making, as well as its potential impact on their well-being. The social desirability scale (Crowne and Marlowe, 1960; Vesely and Klöckner, 2020) was included in the survey to evaluate whether participants were providing socially desirable rather than truthful responses.

Several measurement tools were utilized to assess pain, stress and anxiety levels among the housekeepers. Several questions of the Mainz Pain Staging System (MPSS) (Gerbershagen et al., 1986) were taken to assess the frequency of pain, pain duration and changes in pain intensity. The Workplace Stress Scale developed by the American Institute of Stress (1978) was used, a scale that has also been used in recent research (Sharma and Tripathi, 2023). In addition, statements of the Work Information Anxiety Questionnaire (Sharma and Singh, 2020) were scored from Strongly Disagree to Strongly Agree on a 7-point Likert Scale. The findings from the Workplace Anxiety Questionnaire provided valuable insights into the main stressors of anxiety and its impact on the overall well-being of housekeepers.

A researcher observed the housekeepers during their shifts for one week to gather additional qualitative data. To gather deeper insights, an interview was conducted with the hotel's executive housekeeper to gain a managerial perspective on the well-being

and working conditions of housekeeping employees, using a semi-structured interview. This interview was intended to gather detailed insights on physical, mental and emotional well-being; coping mechanisms; and feedback on the Duvetlifter from the perspective of management.

3 FINDINGS AND DISCUSSION

Table 1 shows the measurements of pain, stress and anxiety to illustrate something of the pain and stress that they are in, even if there is not a large enough sample to allow for substantial quantitative analysis. The measurements about pain show that the situation in the hotel we studied was comparable to the situation identified in the literature (Chela-Alvarez et al., 2022; Shapoval et al., 2022), suggesting substantial pain and stress among the housekeepers. Pain measurements show that six out of eight housekeepers that were observed experience pain somewhere in their body, although there was an indication that the male participants were most reluctant to indicate that they experienced pain/discomfort, a finding consistent with research on gender and pain reporting (Bartley and Fillingim, 2013). The areas where most employees experience pain are the shoulder (3/8) and the lower back (5/8). To cope with the pain, two out of eight housekeepers took pain medication on a weekly basis and one used medication several times a week. Workplace stress scores were above average with an average score of 20 out of 35, showing a substantially high level of stress, although there are substantial variations between the respondents.

Figure 2 illustrates where the eight participants indicated that there was pain in their bodies. (Note that pseudonyms have been used to protect the anonymity of the participants, although male and female names were used to gather some insight into the experiences based upon gender.) There are some patterns in terms of the pains that were reported in the surveys, although it may be unclear if all the pains that are reported were caused by occupational issues or whether they are pre-existing or exacerbated by their experiences at the workplace. The major clusters that appeared from the reports from the employees were issues with regard to the lower back and shoulders, parts of the body that are obviously put under stress during the making of the bed. Five of the eight employees reported having pains in the lower back while three of the eight reported pains in the shoulder areas. Additionally, there were other pains reported by the employees. These data are suggestive that the occupational issues linked with

Table 1 Evaluation of pain, stress and work information anxiety for housekeepers

Housekeeper	Pain intensity (1–7)	Workplace stress (5–35)	Work information anxiety (6–42)
1. Sophia	3	Potentially Dangerous (27)	Moderate (25)
2. Alvaro	3	Moderate (16)	Severe (32)
3. Alejandra	6	Severe (21)	Severe (33)
4. Mateo	1	Moderate (18)	Minimal (11)
5. Clara	3	Moderate (18)	Moderate (16)
6. Patricia	1	Fairly low (14)	Minimal (14)
7. Waldo	1	Severe (24)	Minimal (10)
8. Krish	1	Severe (21)	Moderate (23)
Mean	2.375	19.875	20.5

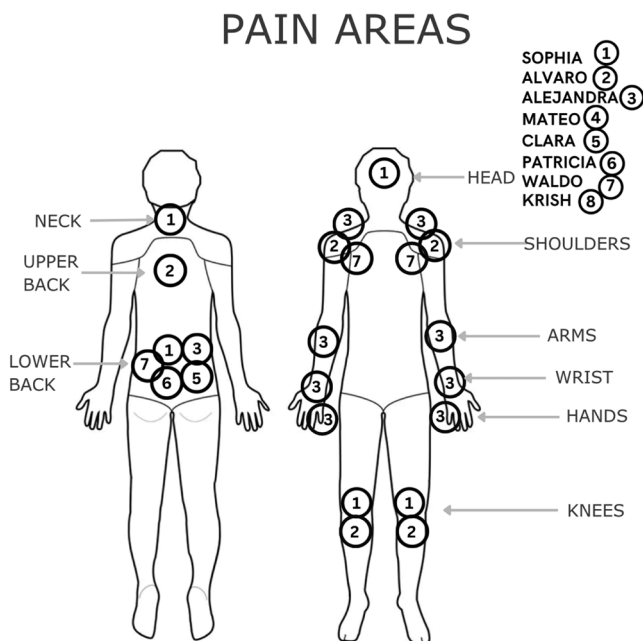


Figure 2 Housekeepers reporting of pain experienced

bending and the use of shoulders impact in a negative way upon the employees, although the actual root source of the pain and the contribution of the workplace to the pain are unclear. At any rate, these findings suggest that innovations should look at alleviating lower back pain and shoulder pain should be a priority.

Apart from reports of pain areas on their bodies, the participants also indicated a great deal about their experiences with pain, workplace stress and work information anxiety, as can be seen in Table 1. The findings illustrate the experiences of various staff members. What is noteworthy is that only about half of the staff members report low levels of pain intensity, while others reported moderate to very high levels of pain intensity. The data also illustrate that many of the respondents report different levels of stress, with one respondent even reporting a potentially dangerous level of stress. In a similar manner, workplace information anxiety showed a great deal of variation, with responses ranging from minimal to severe levels.

The observations of the employees in the workplace furthermore highlighted the high stress levels experienced by the housekeepers. Many faced time-pressure due to the strict time constraint of 45-minute room cleaning set by the hotel operations app. This often leads to stress, especially if the housekeepers must additionally accommodate specific guest requests. It was also noted that the topic of pain and anxiety medication was not openly discussed by the housekeepers. However, one housekeeper mentioned rumours about two colleagues using anxiety medication. The observations also gave insights into the general well-being of housekeepers, such as Alejandra, who had lost her sense of smell, likely due to exposure to strong chemicals. Overall, most of the housekeepers stated that they would prefer to work in pairs, which is already practiced in some companies within the hospitality industry according to Sarosi (2017) to better manage the heavy workload.

The executive housekeeper of the hotel confirmed that the most common pain reported from the team of housekeepers comes from strained backs, which is primarily due to the physicality of the processes of cleaning the room. He also mentioned that some housekeepers switch roles within the company due to the physical demands of their work. According to him, extended sick leaves are uncommon, as housekeepers are expected to assess whether they can handle the job's physical requirements and working conditions; if not, they typically choose to leave the company. He mentioned the high hotel occupancy (92% of the rooms are booked on average every night) and the flexible check-in policy as the main stressors for housekeepers, since it keeps housekeepers more or less continuously engaged in preparing rooms for new guests. Additionally, the housekeepers often need to respond to specific and last-minute requests such as extra beds, increasing workload and time pressure. 'They have to prepare something specific, an extra bed, for example and are bombarded with preferences (...) we have 39 extra sleeping options for 211 rooms. (...) that is a 1 in 5 chance (...) that you have to prepare a different sleeping option'. He also mentioned the guests are also frequently rude to housekeepers, with the most recent occurrence happening just two hours before the interview; such rudeness contributes to the stress of housekeepers. Regarding the use of pain and anxiety medication, the executive housekeeper stated that it is a sensitive topic and can usually only suspect that employees have the issue, due to the reluctance from housekeepers to discuss the topic.

In terms of the effect of the Duvetlifter, observations highlighted that the Duvetlifter was alleviating pain amongst housekeepers. This improvement was mainly due to the adoption of a new posture that required less bending. The housekeepers immediately recognized the tool's design to alleviate pain and confirmed its effectiveness during use. Additionally, the tool simplifies the process of adjusting the blanket, which requires bending and walking around the bed. Furthermore, the Duvetlifter reduced the need for housekeepers to keep their hands raised during the bed-making process, making the task less strenuous.

However, while the Duvetlifter showed promise in terms of reducing physical stress and pain, the usage of the Duvetlifter increased the time needed to change the duvet cover, taking on average 3 minutes for a king-size bed compared to 1.5 minutes for the conventional bed-making. For the smaller beds, it took 2 minutes with the Duvetlifter compared to 41 seconds without, excluding the 2 minutes to assemble and disassemble the tool. It also became apparent that the Duvetlifter was lacking portability and that it does not work in every room, due to its size and the limited space between the bed and the wall. Housekeeper Clara had found different postures to avoid her occupational pain; therefore, the Duvetlifter was not necessary for her to alleviate pain. This showcases the individual strategies for managing physical strain. Interestingly, the male housekeepers, Mateo and Krish, reported no pain and experienced less stress and anxiety, compared to their female counterparts, something expected as it is consistent with previous research on gender and the reporting of pain (Bartley and Fillingim, 2013; Bimpong et al., 2022; Dao and LeResche, 2000).

The executive housekeeper praised the tool for achieving a precise outcome in bed making and its potential to alleviate pain. 'Making the bed is one of the hardest tasks. (...) This tool doesn't solve the whole bed making process. But a big task is handled'. However, he also noted drawbacks, such as the time needed to operate the tool and that the tool was not user-friendly and portable. He also mentioned that the tool does not fit in every room and that its presence can be quite intimidating for guests, compromising the discretion needed in housekeeping duties. He stated that he sees potential in the Duvetlifter but highlights that it needs improvements. Lastly, he mentioned that due to

its precise outcome, he would also see the usage of the tool in showrooms or in ultra-high-net-worth individuals' homes, where precision might be of bigger importance.

4 CONCLUSION: LOW-TECH SOLUTIONS TO A CONTINUOUS NEED

This research has illustrated that there is not only reason to believe that housekeeping staff work under difficult and stressful situations that impact negatively upon their health, as previous research (see, for example, Chela-Alvarez et al., 2021; Faulkner and Patiar, 1997; Sanon, 2013) has shown but also that there can be low-tech solutions to alleviate some of the physical strain of the job. The situation in the hotel we studied is in line with what previous research has highlighted, showing not only that housekeeping is a difficult and stressful job but also that there are some low-tech solutions that can work in ways to improve the job for workers without requiring large investments or operational changes. In this research, we have shown that it is already possible to alleviate pain by developing low-tech specialized tools that can be developed quickly. By using solutions such as the Duvetlifter, it is possible to support employees while at the same time eliminating any risk of them being replaced by technology. An interesting finding is the different male and female differences in the reporting of pain, a finding that could be an artefact of the small sample size. While this is a common finding in research, that females are more likely to report feeling in pain (Bartley and Fillingim, 2013; Bimpong et al., 2022; Dao and LeResche, 2000), it is hopeful that future research will identify the reason that this phenomenon exists.

There are still hurdles with regard to this specific technology. In its current form, using the Duvetlifter increases the time needed to change a bed, which will keep it from being adopted in hotel operations. It is clear that the design needs to be improved but also that employees need to receive longer training to use the tool in an effective and efficient manner. We can expect that future modifications of the tool can assist not only in assisting the workforce in doing their jobs better but also in protecting the well-being of the staff. Such minor innovations with low-tech solutions may assist hotel operations by decreasing turnover and alleviating some of the stress with human resources used in their operations. However, management will have to devise effective ways in which the technology can be used in strategic ways, although there is reason to believe that management commonly struggles to incorporate innovations in strategic ways (Kirkpatrick, Webster and Dedicke, 2024).

One additional managerial implication from the research is the conundrum that management will have to consider. If low-tech tools increase the quality of life of employees but slow down business operations, managers will have to decide whether to place the well-being of employees or whether to discount the well-being of employees. Managers may have to make explicit decisions in favour of the speed of operations over the well-being of employees. While high-tech innovations in business usually speed up efficiency and lower the cost of operations, this specific innovation requires an investment and slows down operations, something management may not want to do, even if giving lip service to caring about the well-being of employees.

Future research should look into how the Duvetlifter can become more efficient, flexible and user-friendly. One way that this can be done is to gather a larger data sample to understand better how innovations impact upon employees and specifically how the Duvetlifter can improve the well-being of hotel employees and labour efficiency in hotels. While much ergonomic research, such as the research presented here,

is based upon small samples, such as Harris-Adamson et al. (2019) with 16 respondents and Huysamen et al. (2018) with 8 respondents, the more the data are gathered, the better the understanding of how innovations can have an impact upon employees. Such research should continue to triangulate, gathering various forms of data from the employee experience (quantitative and qualitative in nature) and also do the same from management. Other research should look into how this technology can be used in other hotels and whether the same strengths and weaknesses can be identified using the same technology. In addition, future research would look into employee acceptance or resistance to using such a technology in the workplace, as some employees may look at the tool as being too cumbersome and difficult to use and may prefer to work in a more physically taxing but fast way, with fewer tools. At any rate, it seems that improvements to the tool can be made in such ways that workers will be able to use it effectively.

In conclusion, the findings from a small sample from an experimental low-tech innovation suggest that some low-tech innovations have the ability to make a contribution to improving the well-being of the workforce, something that the mainstream academic literature often overlooks. While industry and academics frequently focus upon high-tech solutions (see, for example, Ivanov, Webster and Berezina, 2017; Ivanov et al., 2019; González-Santiago et al., 2024; Koerten and Abbink, 2023), there is substantial potential for low-tech solutions that can make meaningful contributions not only to the bottom line of hotel establishments but also improve the well-being of the workforce. Future employees may be standing on the shoulders of not only the brainy developers of high-tech technologies that make their lives better but may also stand on the shoulders of the innovators who develop simple and effective technologies that improve the hospitality experience for employees, guests and managers.

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