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Robot-assisted versus open surgery for radical prostatectomy

Robot-assisted versus laparoscopic surgery for simple or radical hysterectomy

Executive Summary - Assessment Report

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Assessment

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The assessment team is solely responsible for the contents of this report.

Contributions:
Coordination: MS; **conceptualisation and methodological approach**: MB, MS and YT; **clinical results:** MB described the existing clinical results for radical prostatectomy, YT described the existing clinical results for hysterectomy; **health economic analyses:** YT conducted the systematic literature search for both indications, screened the identified literature and was responsible for the quality assessment of the literature; MB was responsible for the data extraction for radical prostatectomy; YT was responsible for the data extraction for hysterectomy; MB developed the cost model for radical prostatectomy, run the cost model and is responsible for the related health economic sections; YT run the cost model for hysterectomy and is responsible for the related health economic sections; YT performed the budget impact analysis of both indications and is responsible for the related health economic sections; **final report:** MB, MS, and YT wrote and agreed upon the content of the final report.

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Background

Cancers of the prostate and of the female reproductive organs are common in Switzerland. Between 2010 and 2014, there were on average 6,087 new prostate cancer cases (crude rate 154.2/100,000) and 1,350 deaths (34.2/100,000) yearly. Prostate cancer is with 28.2% the most common cancer in men and the second most common cause of cancer-related death among men (14.7%) [SFSO and NICER 2016]. In women, between 2010 and 2014, there were 1,754 new cancers of the cervix uteri, corpus uteri (mostly endometrial cancer), or ovaries per year (crude rate 43.3/100,000). Overall, 705 women died from these diseases each year (17.4/100,000). The cancers of the female reproductive organs are with 9.5% the third most common cancer in women and the fourth most common cause of cancer-related death among women (9.6%) [SFSO and NICER 2016].

Treatment for prostate cancer often consists in radical prostatectomy, whereas women with malignant gynaecological diseases often undergo partial or total hysterectomy. Besides malignant conditions there are also benign and pre-malignant conditions often requiring hysterectomy (e.g. benign neoplasms of the ovary, leiomyoma of the uterus, or carcinoma in situ at the cervix uteri).

Both prostatectomy and hysterectomy can be performed with minimally invasive techniques (like simple laparoscopy and robot-assisted laparoscopy) or using an open approach.

Although its effects in terms of clinical effectiveness and costs are still unclear, robot-assisted laparoscopic surgery is increasingly being used. In the last decade more than 30 robotic surgical systems have been installed in Switzerland. Based on the feedback we received from the Swiss hospitals, only da Vinci robots are currently used for radical prostatectomy and hysterectomy.

Aim

The aim of this report was to assess the clinical effectiveness and health economic properties (cost-effectiveness and budget impact) of

- robot-assisted radical prostatectomy (RARP) in comparison to open radical prostatectomy (ORP) for men with localised prostate cancer
- robot-assisted hysterectomy (RAH) in comparison to conventional laparoscopic hysterectomy (CLH) for women with benign or malignant gynaecological disease

The above-mentioned comparisons have been selected as particularly relevant for Switzerland based on the scoping process of this Health Technology Assessment (HTA).

Clinical effectiveness

A 2017 systematic Cochrane Review for radical prostatectomy [Ilic et al. 2017] and a 2018 Cochrane Targeted Update for hysterectomy [Targeted Update 2018] represent the core clinical parts of this assessment. The update for hysterectomy was performed based on a 2014 Cochrane Review of robot-assisted surgery in gynaecology [Liu et al. 2014]. It was commissioned by the Swiss Medical Board and focused on the comparison of RAH vs. CLH.

The Cochrane Review investigating radical prostatectomy included two randomised controlled trials (RCTs) [Guazzoni et al. 2006, Yaxley et al. 2016]. However, only the Australian RCT published by Yaxley et al. compared RARP to ORP [Yaxley et al. 2016]. Based on this study, the authors of the Cochrane Review concluded that RARP may result in a small, possibly unimportant improvement in postoperative pain at day 1 and up to one week, but not at 12 weeks. Little to no difference in postoperative complications or serious postoperative complications were observed. However, RARP may reduce the frequency of blood transfusions after surgery and the length of

hospital stay. The study did not address the outcomes of overall survival, prostate cancer-specific survival or biochemical recurrence-free survival. Finally, urinary and sexual quality of life-related outcomes appeared to be similar after RARP or ORP. The overall quality of evidence was low to moderate for the investigated outcomes.

The Targeted Update of the Cochrane Review investigating hysterectomy for women with benign or malignant gynaecological disease at any stage included six RCTs. All studies compared RAH with CLH, except for one study, which compared RAH with CLH or a vaginal surgical approach for hysterectomy (comparison intervention based on surgeon's choice) [Lönnerfors et al. 2014]. The authors of the Targeted Update reported that RAH may increase the risk of needing blood transfusion and may lead to higher total costs compared with CLH [Targeted Update 2018, Liu et al. 2014]. However, RAH may also lead to a slightly shorter hospital stay. The evidence for a positive effect of RAH on operating time, quality of life, and pain was judged to be of very low quality. Moreover, there was no evidence of an effect on mortality or disease-free survival in cancer patients. The overall quality of evidence was in general low for almost all investigated outcomes.

Health economic analysis

Methodological approach

The health economic part represents the main part of this assessment and consists, for both prostatectomy and hysterectomy, in an investigation of the current practice in Switzerland, a systematic review of the existing health economic literature, a *de novo* cost analysis, and a budget impact analysis.

The overall number of hospitalisations for radical prostatectomy and hysterectomy in Switzerland was investigated using the Swiss Hospital Statistics (SHS) 2015 of the Swiss Federal Statistical Office (SFSO). Moreover, the use of a robot device during surgery was identified using a specific treatment code (CHOP code). For the cost model, information on the frequency of radical prostatectomy and hysterectomy per hospital was extracted from the Swiss Federal Office of Public Health (SFOPH), which published online data for 2015 and 2016. We also contacted systematically the Swiss hospitals that had performed in 2016 radical prostatectomies and hysterectomies (based on the SFOPH information). The hospitals were asked for information concerning the robot system, its comparator intervention, and for related costs for material and staff. Current practice was further investigated through expert consultations in urology and gynaecology. In parallel, we also asked the manufacturer Intuitive Surgical for information on the different robot versions and their costs in Switzerland.

To gain understanding of the available evidence of cost-effectiveness of the investigated interventions, the published literature was analysed. The analysis was based on a literature search using the same search terms as in the Cochrane Review and Targeted Update, in combination with economic terms. After screening of the search results to identify eligible studies, extraction of relevant information, assessment of quality of reporting according to the CHEERS checklist, and assessment of transferability to Switzerland (for international studies) were performed. Relevant studies were analysed and discussed in detail.

The *de novo* cost analyses performed for this assessment assumed that the same cohort of patients would either receive robot-assisted surgery or the comparator intervention. The focus was on cost differences between intervention and comparator, in a given hospital. This implied a focus on the costs of those elements for which a difference between intervention and comparator was expected or at least a plausible possibility. A Swiss health insurance law

("Krankenversicherungsgesetz" - KVG) perspective (considering the direct medical costs of all health care services covered by the Swiss statutory health insurance) as well as a societal perspective (including indirect costs) were used. The model was developed in the following three steps: in step 1, required model elements for RARP and ORP as well as for RAH and CLH were determined. These included primarily economic parameters (the latter mainly related to the robotic system) and economic differences arising from clinical effects. In step 2, corresponding resource consumption (e.g. operation room time required) and differences in clinical effects were determined. Numerical values for clinical and economic elements were compared across different literature sources, with the Cochrane Review and the Targeted Update forming the basis. In step 3, unit costs were assigned. Both the models for radical prostatectomy and hysterectomy included the following parameters: robot system costs, robot maintenance, reusable and consumable surgical equipment costs, reoperation rates, operation room time and surgery time, surgical staff and related costs, anaesthesia staff and related costs, adverse events (AEs) and related costs, length of hospital stay and related costs, and length of time away from work. The radical prostatectomy model included in addition persistent AEs like erectile dysfunction, urinary incontinence, and bladder neck contracture. Other parameters (e.g. oncological outcomes, medication for anaesthetics and antibiotics, catheter removal, outpatient visits) were not included due to missing information or no evidence of any difference between RARP and ORP as well as between RAH and CLH. For both radical prostatectomy and hysterectomy, a base case #1 represented an estimation of the current use of RARP and RAH for a single hospital. A base case #2 (with a different assumption on number of surgeries performed per hospital) and sensitivity analyses investigated a broad range of assumptions.

The budget impact analysis consisted of three main steps: first, the annual occurrence of hospitalisations for prostate cancer, benign and malignant gynaecological diseases in Switzerland was investigated; second, the number of patients undergoing one of the investigated interventions (RARP or ORP; RAH or CLH) was investigated; third, based on annual frequency, the total annual costs were estimated. The total costs for the current practice were compared with a hypothetical increase or decrease of the RARP and RAH uses.
Specifically, information on the total number of men hospitalised with prostate cancer and women hospitalised for a benign or malignant gynaecological disease was obtained from the SHS 2015 provided by the SFSO. Eligible patients were identified through ICD-10 codes "C61: prostate cancer", "C53: malignant neoplasm of cervix uteri", "C54-C55: uterine cancer", "C51-C52, C56-C58: Other malignant neoplasm female genitals", "D06: Carcinoma in situ cervix uteri", "D25: Leiomyoma in the uterus", and "D27: Benign neoplasm of ovary". The gynaecological diseases that received an ICD-10 diagnosis starting with "C" were considered malignant conditions, whereas those that were diagnosed with a code starting with "D" were classified as benign conditions. The SHS only includes patients who were hospitalised (i.e. outpatients were excluded). For the second step, we assumed that all the investigated interventions are usually performed in a hospital setting. The patients with relevant diagnoses who underwent one of the investigated interventions were further examined. In this case, the cases identified by ICD-10 codes were cross-analysed with CHOP treatment codes indicating a radical prostatectomy (e.g. 60.5X.10) or a laparoscopic hysterectomy (e.g. 68.31, 68.41, 68.61). Moreover, the CHOP code 00.99.50, indicating that an operation was performed with a robot, was used to differentiate between RARP and ORP and between RAH and CLH. The resulting frequencies represented the number of cases (not patients). Thus, it was not possible to assess whether there were patients who had repeated surgery during the same calendar year. In a final step, information on the yearly number of surgeries in Switzerland was combined with the estimated direct costs from the cost analysis. The resulting estimations represented the base case illustrating the actual use of RARP, ORP, RAH, and CLH. In order to investigate what would happen with an increased or decreased number of robot-

assisted interventions, the percentage of eligible patients undergoing RARP and RAH was varied from 0% to 100%.

Results for prostatectomy

Current practice

According to the SFOPH, in 2015, there were 2,445 cases of radical prostatectomy performed in 70 Swiss hospitals [SFOPH 2018]. Four hospitals (6%) performed ≥ 100 radical prostatectomies, 14 hospitals (20%) performed 50-99 radical prostatectomies, and 52 hospitals (74%) performed less than 50 radical prostatectomies. According to the same source, in 2016, there were 2,815 cases of radical prostatectomy performed in 70 Swiss hospitals [SFOPH 2018]. Six hospitals (9%) performed ≥100 radical prostatectomies, 17 hospitals (24%) performed between 50 and 99 radical prostatectomies, and 47 hospitals (67%) performed less than 50. This suggests that the total number of radical prostatectomies increased between 2015 and 2016 by +15%.

According to the SHS, in 2015, there were 6,277 hospitalisations for prostate cancer. The percentage of the patients who underwent a radical prostatectomy was 39% (2,453 out of 6,277). Among all patients who underwent radical prostatectomy, 58.9% were operated with a robot. The distribution among hospitals appears to be uneven. Hospitals which have a robot available, tend to use it for RARPS in 80%-100% based on the feedback we received.

Review of the literature

Three cost-effectiveness studies were identified. One was from the United States [Cooperberg et al. 2013], one from Denmark [Hohwü et al. 2011], and one from Canada [Ontario HTA 2017]. Two studies compared RARP with ORP [Hohwü et al. 2011, Ontario HTA 2017]. The aim in Cooperberg et al. was to characterise the costs and outcomes associated with radical prostatectomy vs. radiation therapy. Since the published results showed detailed information on the costs and outcomes of ORP and RARP, it was possible to directly compare the two interventions. The data published by Cooperberg et al. suggested that RARP dominated ORP (i.e. was less expensive and lead to the same if not more QALYs gained). The results published by Hohwü et al. suggested exactly the opposite, with ORP dominating RARP. Finally, the analysis of the Ontario HTA suggested that the costs of using a robotic system are relatively large while the health benefits are relatively small. Thus, RARP did not appear to be cost effective in Ontario. The fact that Cooperberg et al. did not include the costs of the robotic system in their calculations biased the results in favour of RARP and explains why this study showed lower costs for RARP. Hohwü et al. and the Ontario HTA suggested that RARP was more expensive than ORP. The difference between intervention and comparator costs in Hohwü et al. was less pronounced due to the inclusion of indirect costs related to absence from work (EUR 946 vs. CAD 6,235 in the Ontario HTA). If only direct costs were considered, RARP costed EUR 4,506 more than ORP. In all studies, QALY differences between intervention and comparator were minimal. Cooperberg et al. reported incremental QALYs in favour of RARP ranging from 0 to 0.1 over a lifetime horizon. The QALY differences over a one-year time horizon in the other two studies were considerably smaller (0.0013 in favour of ORP in Hohwü et al., 0.0012 in favour of RARP in the Ontario HTA).

De novo cost analysis

The results of the *de novo* cost analysis for radical prostatectomy for base case #1 (assuming 50 RARP that would be replaced with ORP in the comparator strategy, and 25 robot-assisted surgeries for other indications) showed higher total costs per patient for RARP (CHF 24,495) than for ORP (CHF 20,532). The cost difference between the interventions was CHF 3,963. The cost difference between RARP and ORP was mainly due to the higher costs for surgery equipment for RARP (difference of CHF 8,055). In contrast, costs for hospital stay were lower for RARP

(difference of CHF 2,826) due to a shorter hospital stay. Also, staff and operation room costs were lower for RARP (difference of CHF 891) assuming that hourly rates for the operating room and the operating surgeons were the same for RARP as for ORP. Perioperative AE cost were not very different (CHF 376) between RARP and ORP.

When the total number of robot-assisted interventions was raised up to 100 (100 RARPs and no other robot-assisted surgeries) in base case #2, the costs per patient decreased substantially for RARP (CHF 22,949) and stayed constant for ORP (CHF 20,532, ORP costs were independent of the number of conducted surgeries). RARP remained more expensive than ORP. However, the difference was less pronounced resulting in a costs difference of CHF 2,417. It appeared evident that the overall number of robot-assisted surgeries performed per year has a high impact on the total surgery equipment costs and cost difference between the RARP and ORP strategies.

In a sensitivity analysis, we therefore varied the overall number of RARPs per hospital per year from 25 to 500. All other base case input parameter values were left unchanged. The results showed that with an increasing number of robot-assisted surgeries, the cost difference between RARP and ORP decreased significantly. RARP became less expensive after 209 or more RARP uses annually with the same robot.

In one-way deterministic sensitivity analyses all model parameters that could influence the overall cost difference between RARP and ORP were varied individually. Next to the annual number of RARP surgeries, robot system costs, operation room hourly rate for RARP and ORP, and robot life expectancy demonstrated the highest impact.

We also investigated different scenarios. If the hospital does not have to purchase the robot, the costs per patient for RARP and ORP are similar (only CHF 196 higher for RARP). Indirect costs, investigated in a societal perspective, represented 15% of the total costs for RARP and 18% of the total costs for ORP. The cost difference between RARP and ORP decreased from CHF 3,963 to CHF 3,523 for this scenario. The inclusion of additional overhead costs (30%) for the robot increased the costs for RARP, and therefore also for the cost difference between RARP and ORP by additional CHF 1,130. Finally, if surgery and operation room time were assumed shorter for ORP than for RARP (in contrast to the base case where the opposite assumption was the case), RARP would become even more expensive in comparison to ORP.

Budget impact analysis

The results of the budget impact analysis suggested that the total cost for RARP and ORP in 2015 was CHF 56.1 million. This estimation was based on the assumption that 58.9% of the patients undergoing radical prostatectomy were operated with a robot. A hypothetical change from the current use to a scenario in which only ORP were performed would lead to a decrease of the total costs by CHF 5.7 million. On the other hand, in the scenario assuming RARP only, the total costs for radical prostatectomy would decrease by CHF 0.5 million. This was principally due to the fact that a more frequent use of the robots has a direct impact on their amortisation costs (i.e. the mean costs per patients decrease since the robot acquisition costs are distributed to more patients, assuming that an additional robot purchase is not necessary).

Results for hysterectomy

Current practice

According to SFOPH, in 2015, there were 9,883 cases of hysterectomy (all types) for benign conditions performed in 109 Swiss hospitals [SFOPH 2018]. Forty-four hospitals (41%) performed more than 100 hysterectomies, 25 hospitals (23%) performed between 50 and 100

hysterectomies, and 39 hospitals (36%) performed less than 50 hysterectomies. Concerning hysterectomy for malignant disease, a total of 1,230 cases divided among 91 Swiss hospitals was estimated. Only three hospitals (3%) had more than 50 hysterectomies. According to the same source, in 2016, the number of hysterectomies for benign conditions performed in 108 hospitals was 9,858, whereas there were 1, 245 hysterectomies for malignant diseases, distributed between 88 hospitals [SFOPH 2018]. This suggests that the total number of hysterectomies remained constant between 2015 and 2016.

According to the SHS, in 2015, there were 4,581 hospitalisations for malignant neoplasms and 9,412 for benign conditions. Only 22% (1,008 out of 4,851) of the cases diagnosed with a malignant disease underwent a RAH or a CLH. For benign conditions the percentage was much higher (37%, 3,476 out of 9,412). Among all patients who underwent a laparoscopic hysterectomy, only 4.1% were operated with a robot.

Review of the literature

Although the systematic literature search identified a considerable number of economic analyses, these were predominantly cost analyses or reviews. None of them reported information concerning the effectiveness of the interventions in terms of QALYs, LYG, or ICERs based thereupon. It was therefore not possible to investigate via this route whether RAH may be cost-effective or not in comparison to CLH.

De novo cost analysis

The results of the *de novo* cost analysis according to base case #1 (assuming 10 RAHs that would be replaced with CLH in the comparator strategy, and 65 additional robot-assisted surgeries) for both benign and malignant conditions showed higher total costs per patients undergoing RAH (CHF 18,514 vs. CHF 12,950; difference CHF 5,564 for benign conditions and CHF 19,975 vs. CHF 15,642; difference CHF 4,333 for malignant conditions). The cost difference was mainly due to the higher surgery equipment costs for RAH. The main difference between benign and malignant conditions was found in the staff and operation room costs: in benign conditions, surgery time and related costs were higher for RAH, whereas in malignant conditions, the opposite was the case. This was due to different lengths of operation estimated in the Targeted Update. A small difference was also identified in the costs related to AEs, given that according to the Targeted Update, patients undergoing RAH for benign condition had a lower risk of perioperative AEs. In contrast, for malignant conditions, higher AEs rates were estimated for RAH. In base case #2, the assumed number of performed RAH that would be replaced with CLH in the comparator strategy was increased to 100 per year (with an assumption of no additional use of the robot for other diseases). Here, RAH remained more expensive than CLH. However, the difference was less pronounced (especially for malignant conditions). It appeared evident that the overall number of robot-assisted surgeries performed per year has a high impact on the total surgery equipment costs and cost difference between the RAH and CLH strategies.

In the sensitivity analysis, we varied the number of RAH per hospital per year. All other base case input parameter values were left unchanged. The results showed that with increasing numbers of robot-assisted surgeries the cost difference between RAH and CLH decreased. For benign conditions, RAH became less expensive than CLH after more than 693 robot uses (assuming that the robot was used exclusively for RAH). In contrast, for malignant conditions, RAH was less expensive than CLH already after 245 robot-assisted interventions.

The results of the deterministic sensitivity analysis suggested that the factors with the highest impact on the cost difference between RAH and CLH were the total number of robot-assisted procedures per year in a given hospital, the costs of the robot, and its life expectancy.

In the scenario analysis investigating the cost difference using a societal perspective, the cost differences between RAH and CLH decreased from CHF 5,564 to CHF 4,952 for benign conditions and from CHF 4,333 to CHF 3,741 for malignant conditions. Indirect costs represented 9% of the total costs for RAH and 14-16% of the total costs for CLH. In another scenario excluding robot purchase costs, the cost differences between RAH and CLH were CHF 1,763 for benign conditions and CHF 533 for malignant conditions.

Budget impact analysis
The results of the budget impact analysis suggested that the total direct costs of patients undergoing RAH or CLH in Switzerland were CHF 79.9 million in 2015. The costs for RAH represented only 5.6% of the total hysterectomy costs. This was mainly because the estimated frequency of robot-assisted interventions for benign and malignant neoplasms was very low (4.1%). A hypothetical change from the current use to a scenario in which only CLH were performed would lead to a decrease of the total costs by CHF 1.3 million. On the other hand, in the scenario assuming RAH only, the total costs for hysterectomy would increase by CHF 4.0 million. This was principally due to the fact that a more frequent use of the robots has a direct impact on their amortisation costs (i.e. the mean costs per patients decrease since the robot acquisition costs are distributed to more patients, assuming that an additional robot purchase is not necessary).

Discussion and conclusion
The use of robot assistance for radical prostatectomy in Switzerland appears to reach around 60% according to the SFSO data. The distribution among hospitals appears to be uneven, with some hospitals, including large ones, predominantly performing RARPs. Concerning hysterectomy, the use of robotic assistance seems to be below 5%. Although the distribution among hospitals may vary, RAHs are in general rarely performed.

The studies identified in the literature review for radical prostatectomy suggested that RARP is more expensive but shows small QALY differences if compared to ORP over a period of one year. Long-term, meaningful cost-effectiveness results are not yet available. No cost-effectiveness study was identified for hysterectomy.

In our *de novo* cost analysis, the costs of RARPs from a KVG perspective were about CHF 4,000 higher than for ORP when only 75 robot-assisted surgeries (50 RARP and 25 for other indications) per year were assumed per hospital in Switzerland. The number of robot-assisted surgery performed yearly, robot system costs, operation room hourly rate for RARP and ORP, and robot life expectancy had a high impact on the cost differences between RARP and ORP. Cost offsets related to fewer early and persistent AEs under RARP were small for the time horizon of maximum one year. RARP seemed to be less costly in hospitals with a higher number of robot-assisted surgeries (and might be less expensive than ORP for 209 and more robot-assisted surgeries per hospital per year).

Concerning hysterectomy, the costs of RAHs were about CHF 5,500 higher than for CLH for benign conditions and about CHF 4,300 higher for malignant conditions, when only 75 robot-assisted surgeries (10 RAHs and 65 for other indications) per year were assumed per clinic in Switzerland. The parameters showing a high impact on the cost differences between RAH and CLH were the same as for prostatectomy. For benign conditions, RAH became less expensive than CLH after more than 693 robot uses. In contrast, for malignant conditions, RAH was less expensive than CLH already after 245 uses.

In the budget impact analyses, we investigated the costs difference between the actual use of robot-assisted surgery and a hypothetical increase or decrease of its use. The budget impact

analyses showed that changing the current practice toward a higher use or robot assistance would have a limited impact on the total costs of radical prostatectomy and hysterectomy (as long as no additional robots need to be bought). Increasing the percentage of performed RARP to 100% would lead to a cost decrease of approximately CHF 0.5 million. For hysterectomy, an increase of RAH to 100% would costs CHF 4.0 million per year.

It is important to consider that switching back to ORP/CLH or switching forward to RARP/RAH would have transition costs (e.g. related to additional robot purchase or surgeon training) which we could not consider.

The main strengths of this HTA were the use of recently published Cochrane Reviews to assess the clinical effectiveness as well as the incorporation of consistent Swiss data in the *de novo* cost analysis and in the budget impact analysis.

Main limitations are the generally low quality of evidence reported in the Cochrane Reviews, the lack of long-term information, and the lack of data on several potentially important parameters (e.g. oncological outcomes, hospital readmission, overall survival, recurrence, quality of life). Given the lack of data, we could not assess the potential influence of learning curves on the surgery quality (e.g. in terms of surgery duration or perioperative AEs). However, it should be emphasised that an increased number of robot-assisted surgeries per year would lead to a higher number of conducted RARP/RAH per surgeon. It is reasonable to assume that surgeons with high experience may operate more efficiently if compared to surgeons with a low caseload.

For this health economic analysis, it was partially difficult to obtain access to Swiss cost data. Aggregated cost data for key cost parameters were made available by one public hospital. Further RCTs including longer-term clinical data and Swiss cost data from various sources would be necessary to perform a more solid health economic analysis.

The fact that only da Vinci robots are currently used in Switzerland for radical prostatectomy and hysterectomy provides the US manufacturer with a quasi-monopoly position until other manufacturers enter the Swiss marked. The entrance of competitors like TransEnterix, which is currently ongoing for visceral surgery in Switzerland, may lower the costs of the robotic devices and, consequently, of RARPs and robot-assisted surgeries.

In conclusion, we could not assess the long-term cost-effectiveness or cost impact of RARP and RAH, in comparison with ORP and CLH, given a profound lack of valid long-term data. In the short-term, the robot-assisted approaches induce additional costs as long as the number of uses per robot and year remain at a low to intermediate level. Notably, the overall budget impact of the robot-assisted approaches increases only modestly with increasing use, as higher case numbers imply a substantial reduction of per-patient amortisation costs.