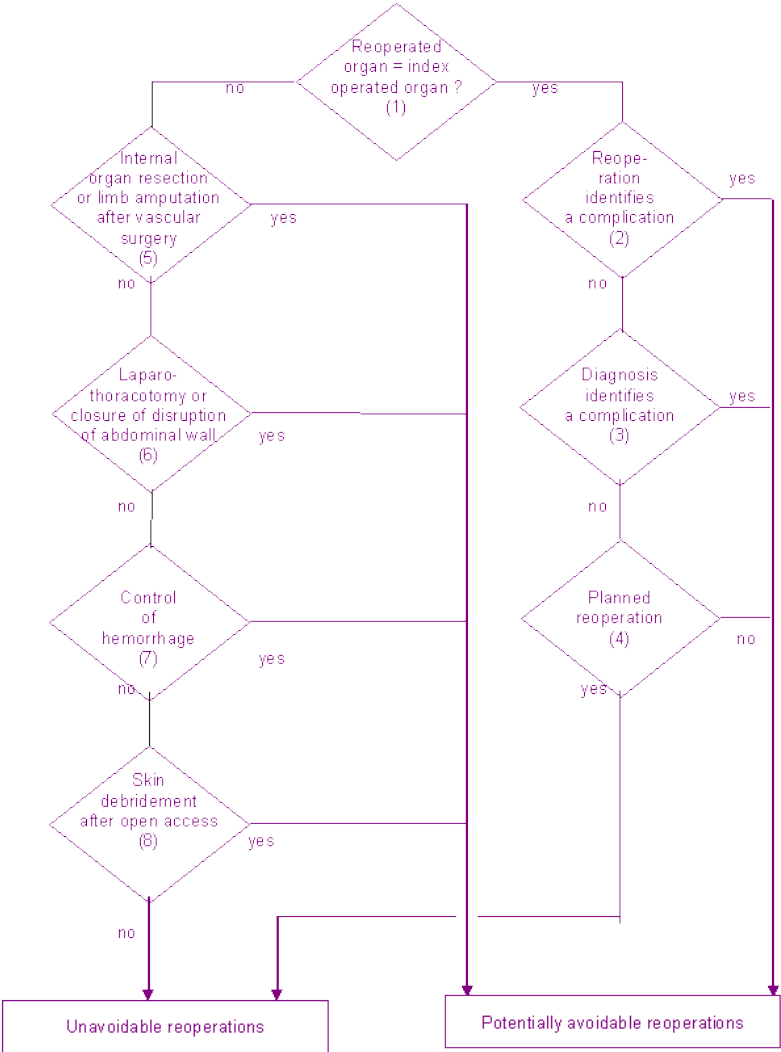


Potentially avoidable reoperations - algorithm

Figure 1 shows the algorithm that is proposed to screen potentially avoidable reoperations. Each bifurcation in the graph is called a step; steps are numbered 1 through 8. Clinical judgment was used to allocate each ICD9-CM procedure code and ICD 10 diagnosis code of surgery related complications to 30 organ groups (Appendix A, step 1). Some procedures were assigned to two organ groups: for instance a repair of a fistula involving a urinary and a digestive organ, an amputation of a limb segment which was also allocated to the distal adjoining limb part. Reoperations were classified as potentially avoidable if the same organ group was involved in both the index operation and a complication related to surgery (steps 2 and 3) or an unplanned reoperation (step 4). Some reoperations on another organ group were also classified as potentially avoidable if organ resection after a vascular procedure (step 5), reopening of laparotomy or thoracotomy (step 6), control of haemorrhage (step 7), revision of a surgical wound (step 8). The sensitivity and the specificity of the method applied on the 406 operation/reoperation pairs of the test sample reach respectively 75% and 72%.



Step 1. List of operated organs

All spinal canal structures. Bone or joint of unspecified site. Brain, pituitary gland and skull. Chest wall, mediastinum and thymus*. Cranial and peripheral nerves. Ear. Eyeball and orbit. Facial bones and nose. Finger. Forearm and elbow. Hand and wrist. Heart, valves and coronary vessels*. Hip and femur. Kidney, adrenal glands and urinary tract**. Knee. Larynx and trachea. Leg, foot, toes, lower limb not otherwise specified. Liver, biliary tract and pancreas**. Lung and pleura*. Nasal sinus. Oesophagus, stomach, intestine, rectum, anus and peritoneum**. Oral cavity, pharynx, tonsils. Ovary, uterus, vagina and vulva**. Penis. Shoulder and arm and upper limb not otherwise classified. Skin, subcutaneous tissue, muscle and breast. Spleen and lymphatic structures. Testes, scrotum, and spermatic structures. Thyroid and parathyroid. Vessels.

*organs considered as thoracic site. ** organ considered as abdominal or pelvic site (see step 3).

Step 2. Reoperation procedures identifying a surgery related complication

Reoperation procedures ICD-9-CM codes (reopening of a surgical site) :

0123, 0242, 0302, 0397, 0475, 0602, 1152, 1266, 1283, 156, 1662, 1663, 1664, 1666, 1921, 1929, 196, 2062, 2092, 2184, 2763, 3163, 3174, 3403, 3595, 3775, 3779, 3942, 3949, 445, 4640, 4641, 4643, 4693, 4694, 5194, 5412, 5461, 5492, 5652, 5662, 5672, 5722, 8153, 8155, 8159, 8197, 843, 8593, 8675.

Reoperation procedures ICD-9-CM codes (surgery for post-surgical hemorrhage or hematoma) :

287, 3941, 3998, 4443, 4449, 5793, 6094.

Reoperation procedures ICD-9-CM codes (reoperation for surgery related injury) :

3161, 3171, 3341, 3343, 3482, 4282, 4461, 4671, 4673, 4675, 4871, 5061, 5191, 5581, 5682, 5781, 5841, 6141, 6381, 6761, 6941.

Reoperation procedures ICD-9-CM codes (closure of a fistula) :

1282, 2182, 2271, 2642, 2753, 2952, 2953, 3162, 3173, 3342, 3473, 3483, 4063, 4284, 4463, 4672, 4674, 4676, 4792, 4873, 4893, 4911, 4912, 4973, 5193, 5583, 5684, 5783, 5784, 5843, 6142, 6762, 6942, 7072, 7073, 7074, 7075, 7172.

Reoperation procedures ICD-9-CM codes (amputation of lower limb) :

8400, 8401, 8402, 8403, 8404, 8405, 8406, 8407, 8408, 8409, 8410, 8411, 8412, 8413, 8414, 8415, 8416, 8417, 8418, 8419.

Step3. ICD 10 diagnosis codes identifying a surgery related complications

Complications related to surgical care

E890, E891, E892, E893, E894, E895, E896, E898#, E899#, G970, G971, G972, G978, G979, H590, H598, H599, H950, H951, H958, H959, I970, I971, I972, I978, I979, J950, J951, J952, J953, J954, J955, J958, J959, K430, K431, K439, K660, K910, K911, K912, K913, K914, K915, K918, K919, M020, M0200, M0201, M0202, M0203, M0204, M0205, M0206, M0207, M0208, M0209, M801, M8010, M8011, M8012, M8013, M8014, M8015, M8016, M8017, M8018, M8019, M803, M8030, M8031, M8032, M8033, M8034, M8035, M8036, M8037, M8038, M8039, M811, M8110, M8111, M8112, M8113, M8114, M8115, M8116, M8117, M8118, M8119, M813, M8130, M8131, M8132, M8133, M8134, M8135, M8136, M8137, M8138, M8139, M840, M8400, M8401, M8402, M8403, M8404, M8405, M8406, M8407, M8408, M8409, M841, M8410, M8411, M8412, M8413, M8414, M8415, M8416, M8417, M8418, M8419, M960, M961, M963, M964, M966, M968, M969, N990, N991, N992, N993, N994, N995, N998#, N999#, O357, T810#, T811#, T812#, T813#,

T814#, T815#, T816#, T817#, T818#, T819#, T820, T821, T822, T823, T824, T825, T826, T827, T828, T829, T830, T831, T832, T833, T834, T835, T836#, T838#, T839#, T840, T841, T842, T843, T844, T845, T846, T847, T848, T849, T850, T851, T852, T853, T854, T855, T856#, T857#, T858#, T859#, T861, T862, T863#, T864, T868#, T869#, T870, T871, T872#, T873, T874, T875, T876, T888#, T889#,

Complication related to an abortion or a delivery

O040, O041, O042, O043, O044, O045, O046, O047, O048, O050, O051, O052, O053, O054, O055, O056, O057, O058, O070, O071, O072, O073, O074, O075, O076, O077, O078, O079, O080, O081, O082, O083, O084, O085, O086, O087, O088, O089, O700, O701, O702, O703, O709, O713, O714, O715, O716, O717, O718, O719, O720, O721, O722, O751, O754, O85, O860, O861, O862, O863, O864, O868, O870, O871, O873, O879, O880, O881, O882, O883, O888, O900, O901, O902, O95, O96, O97,

Some infections of a surgical site classified elsewhere

J850, J851, J852, J853, J860, J869, M000, M0000, M0001, M0002, M0003, M0004, M0005, M0006, M0007, M0008, M0009, M001, M0010, M0011, M0012, M0013, M0014, M0015, M0016, M0017, M0018, M0019, M002, M0020, M0021, M0022, M0023, M0024, M0025, M0026, M0027, M0028, M0029, M008, M0080, M0081, M0082, M0083, M0084, M0085, M0086, M0087, M0088, M0089, M009, M0090, M0091, M0092, M0093, M0094, M0095, M0096, M0097, M0098, M0099, M462, M4620, M4621, M4622, M4623, M4624, M4625, M4626, M4627, M4628, M4629, M463, M4630, M4632, M4633, M4634, M4635, M4636, M4637, M4638, M4639, M862, M8620, M8621, M8622, M8623, M8624, M8625, M8626, M8627, M8628, M8629, M863, M8630, M8631, M8632, M8633, M8634, M8635, M8636, M8637, M8638, M8639, M864, M8640, M8641, M8642, M8643, M8644, M8645, M8646, M8647, M8648, M8649, M866, M8660, M8661, M8662, M8663, M8664, M8665, M8666, M8667, M8668, M8669, M868, M8680, M8681, M8682, M8683, M8684, M8685, M8686, M8687, M8688, M8689, M869, M8690, M8691, M8692, M8693, M8694, M8695, M8696, M8697, M8698, M8699,

Complications are retained if they affect a reoperated organ group or if the damaged organ cannot be specified (codes indicated with #)

Step 4. Planned reoperations

Reoperation procedure ICD-9-CM codes (removal of a temporary device)

0122, 0207, 0243, 0394, 0398, 0493, 1192, 146, 1671, 1672, 3764, 3785, 3786, 3787, 3789, 3798, 3799, 3943, 4494, 5195, 5598, 5694, 5798, 6694, 7697, 7860, 7861, 7862, 7863, 7864, 7865, 7866, 7867, 7868, 7869, 8000, 8001, 8002, 8003, 8004, 8005, 8006, 8007, 8008, 8009, 8393, 8594, 8596.

Reoperation procedure ICD-9-CM codes (temporary stomy closure)

3172, 3472, 4283, 4462, 4650, 4651, 4652, 4872, 5192, 5582, 5683, 5782, 5842.

Reoperation procedure ICD-9-CM codes (anastomosis of two hollow organs after a temporary stomy)

4251, 4252, 4254, 4255, 4256, 4258, 4259, 4261, 4262, 4263, 4264, 4265, 4266, 4268, 4269, 437, 4439, 4590, 4591, 4592, 4593, 4594, 4595, 4874, 5131, 5132, 5133, 5134, 5135, 5136, 5137, 5139, 5296, 5586, 5673, 5674, 5675, 5679, 5788, 5844, 6383, 6672, 6673, 6674, with one of the following index procedure ICD-9CM codes : 022, 0981, 0982, 0983, 311, 3121, 3129, 3163, 3174, 4210, 4211, 4219, 4311, 4319, 4610, 4611, 4613, 4614, 4620, 4621, 4622, 4623, 4624, 4631, 4632, 4639, 4640, 4641, 4791, 481, 5102, 5103, 5502, 5503, 5504, 5512, 5651, 5652, 5661, 5662, 5717, 5718, 5721, 5722, 6602.

Reoperation procedure ICD-9-CM codes (Cholecystectomy or anastomosis of biliary duct after relief of a biliary obstruction by endoscopy) :

5121, 5122, 5123, 5124, 5131, 5132, 5133, 5134, 5135, 5136, 5137, 5139, 5194, with one of the following index procedure ICD-9-CM codes : 5102, 5141, 5164, 5181, 5184, 5185, 5187, 5188, 5196, 5198.

Reoperation procedure ICD-9-CM codes (Implantation of prosthesis or other devices) :

0205, 0293, 0296, 0393, 0492, 1173, 1370, 1371, 1372, 1441, 1661, 1662, 2095, 2096, 2097, 2098, 3485, 3606, 3761, 3762, 3763, 3765, 3766, 3767, 3770, 3771, 3772, 3773, 3774, 3775, 3779, 3780, 3781, 3782, 3783, 3794, 3795, 3796, 3964, 3993, 4493, 4992, 5187, 5293, 5597, 5692, 5796, 5893, 6495, 6497, 6693, 7692, 7890, 7891, 7892, 7893, 7894, 7895, 7896, 7897, 7898, 7899, 7999, 8151, 8152, 8153, 8154, 8155, 8156, 8157, 8159, 8180, 8181, 8184, 8197, 8392, 8440, 8444, 8448, 8533, 8535, 8553, 8554, 8593, 8595, 8606, 8607.

Reoperation procedure ICD-9-CM codes (Any neurosurgical intervention after a ventricular or subarachnoid shunt) :

0122, 0124, 0125, 0131, 0132, 0139, 0141, 0142, 0151, 0152, 0153, 0159, 016, 0201, 0202, 0203, 0204, 0205, 0206, 0207, 0211, 0212, 0214, 022, 0231, 0232, 0233, 0234, 0235, 0239, 0241, 0243, 0291, 0292, 0293, 0296, 0299, 0301, 031, 0321, 0329, 034, 0351, 0352, 0353, 0359, 036, 0371, 0372, 0379, 0393, 0394, 0396, 0398, 0399, 0752, 0753, 0754, 0759 with one of following index procedure ICD-9-CM codes : 0231, 0232, 0233, 0234, 0235, 0239, 0241, 0242, 0371, 0372, 0379, 0397.

Reoperation and index procedure ICD-9-CM codes (two successive catheter based repairs of vessels):

3601, 3602, 3605, 3606, 3609, 3990, 3993, without any of following exclusion secondary diagnoses ICD-10 codes : I21.x, I22.x.

Reoperation and index procedure ICD-9-CM codes (two endoscopic procedures on digestive or urinary system) :

4201, 4232, 4233, 4281, 4283, 4291, 4292, 4311, 4341, 4422, 4443, 4462, 4493, 4494, 4530, 4542, 4543, 4643, 4685, 4831, 4832, 4833, 4834, 4835, 4836, 4841, 4849, 4874, 4911, 5221, 5293, 5294, 5298, 5492, 5502, 5503, 5504, 5512, 5582, 5597, 5598, 560, 562, 5683, 5691, 5692, 5694, 5717, 5718, 5741, 5749, 5751, 5782, 5791, 5792, 5793, 5796, 5798, 581, 5831, 5842, 585, 586, 5891, 5893, 6021, 6029, 6094, 6095, 6096, 6097

Reoperation procedure ICD-9-CM codes (graft, transplantation or reconstructive surgery) :

0202, 0203, 0204, 0206, 0212, 0292, 0351, 0352, 0353, 0359, 045, 046, 0476, 0479, 0581, 0744, 0793, 0794, 0831, 0832, 0833, 0834, 0835, 0836, 0837, 0838, 0842, 0843, 0844, 0849, 0859, 0861, 0862, 0863, 0864, 0869, 0870, 0871, 0872, 0873, 0874, 0882, 0883, 0884, 0885, 0889, 0971, 0972, 0973, 1041, 1042, 1043, 1044, 1049, 106, 1131, 1132, 1152, 1153, 1159, 1160, 1161, 1162, 1163, 1164, 1169, 1171, 1172, 1174, 1176, 1179, 1235, 1239, 1274, 1285, 1286, 1287, 1288, 1431, 1435, 1439, 1449, 1451, 1459, 1511, 1512, 1519, 155, 157, 1665, 1681, 1682, 1689, 185, 186, 1871, 1879, 194, 1952, 1953, 1954, 1955, 199, 2093, 2172, 2183, 2185, 2186, 2187, 2188, 2189, 2279, 242, 245, 2559, 2649, 2754, 2755, 2756, 2757, 2759, 2762, 2769, 2773, 294, 2959, 3164, 3169, 3175, 3179, 3221, 3334, 3348, 3349, 3350, 3351, 3352, 336, 3474, 3479, 3484, 3493, 3510, 3511, 3512, 3513, 3514, 3533, 3550, 3551, 3552, 3553, 3554, 3560, 3561, 3562, 3563, 3570, 3571, 3572, 3573, 3581, 3582, 3583, 3584, 3591, 3596, 3601, 3602, 3603, 3605, 3609, 3610, 3611, 3612, 3613, 3614, 3615, 3616, 3617, 3619, 362, 3631, 3632, 3639, 3691, 3699, 374, 375, 3922, 3924, 3925, 3928, 3929, 3950, 3951, 3952, 3956, 3957, 3958, 3959, 3966, 3971, 3979, 3990, 4194, 4195, 4253, 4285, 4287, 4289, 4381, 4429, 4431, 4465, 4466, 4469, 4642, 4679, 4697, 4879, 4972, 4974, 4979, 5051, 5059, 5069, 5172, 5179,

5183, 5280, 5282, 5283, 5284, 5285, 5286, 5295, 5300, 5301, 5302, 5303, 5304, 5305, 5310, 5311, 5312, 5313, 5314, 5315, 5316, 5317, 5321, 5329, 5331, 5339, 5341, 5349, 5351, 5359, 5361, 5369, 537, 5380, 5381, 5382, 539, 5471, 5472, 5473, 5474, 5475, 5561, 5569, 5587, 5589, 5689, 5785, 5786, 5787, 5789, 5845, 5846, 5847, 5849, 593, 5979, 6093, 6149, 6269, 6359, 6382, 6389, 6443, 6444, 6449, 645, 6573, 6576, 6579, 6679, 675, 6769, 6921, 6923, 6929, 6949, 7050, 7051, 7052, 7061, 7062, 7079, 7179, 7536, 7550, 7551, 7552, 7561, 7562, 7569, 7593, 7641, 7643, 7644, 7646, 765, 7661, 7662, 7663, 7665, 7666, 7667, 7668, 7669, 7670, 7672, 7674, 7676, 7677, 7679, 7691, 7694, 7751, 7752, 7753, 7754, 7756, 7757, 7758, 7800, 7801, 7802, 7803, 7804, 7805, 7806, 7807, 7808, 7809, 7840, 7841, 7842, 7843, 7844, 7845, 7846, 7847, 7848, 7849, 7850, 7851, 7852, 7853, 7854, 7855, 7856, 7857, 7858, 7859, 7870, 7871, 7872, 7873, 7874, 7875, 7876, 7877, 7878, 7879, 7920, 7921, 7922, 7923, 7924, 7925, 7926, 7927, 7928, 7929, 7930, 7931, 7932, 7933, 7934, 7935, 7936, 7937, 7938, 7939, 7950, 7951, 7952, 7955, 7956, 7959, 7980, 7981, 7982, 7983, 7984, 7985, 7986, 7987, 7988, 7989, 8140, 8142, 8143, 8145, 8146, 8147, 8149, 8171, 8172, 8174, 8175, 8179, 8182, 8183, 8185, 8196, 8232, 8234, 8251, 8252, 8256, 8257, 8258, 8259, 8269, 8271, 8272, 8279, 8282, 8283, 8284, 8286, 8289, 8363, 8371, 8375, 8376, 8377, 8379, 8381, 8382, 8383, 8385, 8386, 8387, 8388, 8389, 8531, 8532, 8550, 857, 8582, 8583, 8584, 8585, 8586, 8587, 8589, 8660, 8661, 8662, 8663, 8664, 8665, 8666, 8667, 8669, 8670, 8671, 8672, 8673, 8674, 8681, 8683, 8685, 8686, 8689.

These procedure codes are not considered as planned if they were preceded by an index procedure included in the above list, except if ICD-10 diagnoses codes were : T20 to T32.9 or Z42.x.

Reoperation procedure ICD-9-CM codes (Excision, incision, resection or suture of skin or muscular tissue after excision, incision or resection of skin or muscular tissue) :

543, 8302, 8303, 8309, 8311, 8312, 8313, 8314, 8331, 8332, 8339, 8341, 8342, 8343, 8344, 8345, 8349, 8361, 8362, 8364, 8365, 8384, 8605, 8609, 8621, 8622, 8623, 8625, 8627, 8628, 863, 864, 8682, 8691 and one of the following index procedure ICD-9-CM codes : 543, 8302, 8303, 8309, 8311, 8312, 8313, 8314, 8331, 8332, 8339, 8341, 8342, 8343, 8344, 8345, 8349, 8384, 8605, 8609, 8621, 8622, 8623, 8625, 8627, 8628, 863, 8682, 8691.

Step 5. Internal organ resection or limb amputation after vascular surgery

Reoperation procedures ICD-9-CM codes (internal organ resection or limb amputation) :

0125, 0152, 0153, 0302, 0405, 0406, 0522, 0523, 0524, 0525, 0529, 062, 0639, 064, 0650, 0651, 0652, 0681, 0689, 0722, 0729, 073, 0753, 0754, 0764, 0765, 0780, 1369, 1471, 1472, 1473, 1474, 1639, 1641, 1642, 1649, 1651, 1659, 1664, 2041, 2042, 2049, 2092, 252, 253, 254, 2630, 2632, 2933, 301, 3029, 303, 304, 321, 3222, 323, 324, 325, 329, 3451, 3534, 3731, 3735, 4040, 4041, 4042, 4050, 4051, 4052, 4053, 4054, 4059, 4143, 415, 4240, 4241, 4242, 435, 436, 4389, 4391, 4399, 4402, 4403, 4561, 4562, 4563, 4571, 4572, 4573, 4574, 4575, 4576, 458, 4602, 4604, 4701, 4709, 4711, 4719, 485, 4861, 4862, 4863, 4864, 4865, 4869, 4892, 4912, 5022, 503, 504, 5121, 5122, 5124, 5251, 5252, 5253, 5259, 526, 527, 554, 5551, 5552, 5553, 5554, 5640, 5641, 5642, 576, 5771, 5779, 603, 604, 605, 6062, 6069, 6522, 6524, 6531, 6539, 6541, 6549, 6553, 6554, 6563, 6564, 664, 6651, 6652, 6662, 6663, 683, 684, 6851, 6859, 686, 687, 688, 689, 715, 7161, 7162, 7631, 7639, 7642, 7645, 7700, 7702, 7705, 7709, 7759, 7780, 7781, 7782, 7783, 7784, 7785, 7787, 7788, 7789, 7790, 7791, 7792, 7793, 7794, 7795, 7797, 7798, 7799, 8070, 8071, 8072, 8073, 8074, 8075, 8076, 8077, 8078, 8079, 835, 8400, 8401, 8402, 8403, 8404, 8405, 8406, 8407, 8408, 8409, 8410, 8411, 8412, 8413, 8414, 8415, 8416, 8417, 8418, 8419.

and index operation procedures ICD-9-CM codes (vascular surgery) :

0213, 0743, 3601, 3602, 3603, 3605, 3606, 3609, 3610, 3611, 3612, 3613, 3614, 3615, 3616, 3617, 3619, 362, 3631, 3632, 3639, 3691, 3699, 3800, 3801, 3802, 3803, 3804, 3805, 3806, 3807, 3808, 3809, 3810, 3811, 3812, 3813, 3814, 3815, 3816, 3818, 3830, 3831, 3832, 3833, 3834, 3835, 3836, 3837, 3838, 3839, 3840, 3841, 3842, 3843, 3844, 3845, 3846, 3847, 3848, 3849, 3850, 3851, 3852, 3853, 3855, 3857, 3859, 3860, 3861, 3862, 3863, 3864, 3865, 3866, 3867, 3868, 3869, 387, 3880, 3881, 3882, 3883, 3884, 3885, 3886, 3887, 3888, 3889, 3894, 390, 391, 3921, 3922, 3923, 3924, 3925, 3926, 3927, 3928, 3929, 3930, 3931, 3932, 3941, 3942, 3943, 3949, 3950, 3951, 3952, 3953, 3954, 3955, 3956, 3957, 3958, 3959, 3961, 3962, 3963, 3965, 3966, 3971, 3979, 398, 3990, 3991, 3993, 3998, 3999.

Step 6. Laparo- and thoracotomy or reclosure of disruption of abdominal wall

Reoperation procedures ICD-9-CM codes:

3401, 3402, 3403, 3409, 341, 3473, 5411, 5412, 5419, 5461, 5495 and one index procedure belonging to a thoracic, abdominal or pelvic organ (see step 1).

Step 7. Control of haemorrhage

Reoperation procedures ICD-9-CM code:

3998

Step 8. Skin debridement after open surgery for wound complications

Reoperation procedures ICD-9-CM code:

543, 8302, 8303, 8309, 8311, 8312, 8313, 8314, 8331, 8332, 8339, 8341, 8342, 8343, 8344, 8345, 8349, 8361, 8362, 8364, 8365, 8384, 8605, 8609, 8621, 8622, 8623, 8625, 8627, 8628, 863, 864, 8682, 8691.

and ICD-10 diagnoses codes :

T815, T854, T874, T875, T876.