

The use of a smartphone application to disseminate guidelines on pancreatic cystic neoplasms

INTRODUCTION

Notwithstanding the existence of expert consensus policies¹⁻³ regarding the management of pancreatic cystic neoplasms (PCNs) for more than a decade, the lack of data on guidelines application in the real world is a matter of concern.^{4,5} If guidelines are not enforced in clinical practice, this can result in serious inequalities in terms of PCNs' management. Indeed, whereas most practitioners dealing with PCNs allege to know the available guidelines for their clinical practice,⁶ which guidelines are chosen in specific clinical scenarios is yet unknown.

Smartphone applications are becoming increasingly popular in the modern era and have proven to be useful tools in routine clinical practice. There are currently more than 50,000 healthcare applications for smartphones available in online stores (<https://www.statista.com/>), steadily increasing over previous years. A smartphone application for both iOS and Android, named "iCyst", was developed aiming to implement the dissemination of available guidelines and reducing possible discrepancies in PCNs management.

iCYST APP

Officially release in October 2019, iCyst was developed as part of the project entitled "Current application of the European evidence-based guidelines on pancreatic cystic tumors", which was promoted by the Department of General and pancreatic Surgery – The Pancreas Institute, University of Verona Hospital Trust (Institutional Review Board approval number 2390CESC – Comitato Etico delle Province di Verona e Rovigo), and received funding from the United European Gastroenterology Activity Grants – Support of Standards & Guidelines initiatives, dissemination of existing clinical practice 2019 (endorse by the European Digestive Surgery – EDS).

The app consists of two discrete sections (Figure 1). The "guideline consultation section" was designed for users to navigate

through the European evidence-based,¹ International Association of Pancreatology (IAP),² and American Gastroenterological Association (AGA)³ guidelines and to browse the flow charts of each set of guidelines. Both a digitalized format of the actual guideline papers and a standardized form of the guideline flowcharts are displayed. In the simulation section, the user can simulate a specific case scenario and obtain the recommendations of the three guidelines based on the clinical and radiological features entered in the app.

A specific algorithm (Figure 2) was created based on the PCN classifications and definitions of both the clinical and radiological features derived from the included guidelines.¹⁻³ According to the specific characteristics entered, iCyst can provide advice based on each guideline. The users can select the management of their choice or the "none" button, in the case of disagreement with each of the guidelines' recommendations. The simulations are safely saved in the user profile in a deidentified fashion, and a datasheet including all the entered simulations is available for extraction from the app itself.

iCyst collects information including the users' name, surname, email, specialty, country, and affiliation. All data collection procedures are in line with the requirements of the European Union's General Data Protection Regulation (GDPR) (<https://gdpr-info.eu>). iCyst did not collect sensitive data about patients. In the "add new patients" section, the user can simulate several clinical cases by entering age, sex and all the clinical and radiological features covered in the guidelines for PCN management. Each case entered is assigned with a unique alphanumeric code to allow the user to retrieve the entered data. The information provided and the app utilization data were used to improve the iCyst user experience, to periodically update iCyst and to achieve the purpose of the project by improving evidence about the application and dissemination of guidelines on PCNs in clinical practice. iCyst was first developed in the English language. Further updates have also been made available in Russian, Romanian and Italian to increase its use among non-English-speaking users. To allow for data analysis, all inserted case simulations were eventually accrued into 6 discrete representative scenarios.

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CASE SIMULATIONS

One year after the release, iCyst app appeared on online stores more than 7000 times and was downloaded more than 1000 times. Most of the downloads were from Spain (258), Italy (212), Germany (106), the USA (68), and Russia (64) (Figure 3).

A total of 1020 complete simulations were entered by 276 iCyst users (Table 1). The number of downloads increased consistently throughout the year. iCyst users were mostly European (88%) and

FIGURE 1 iCyst download

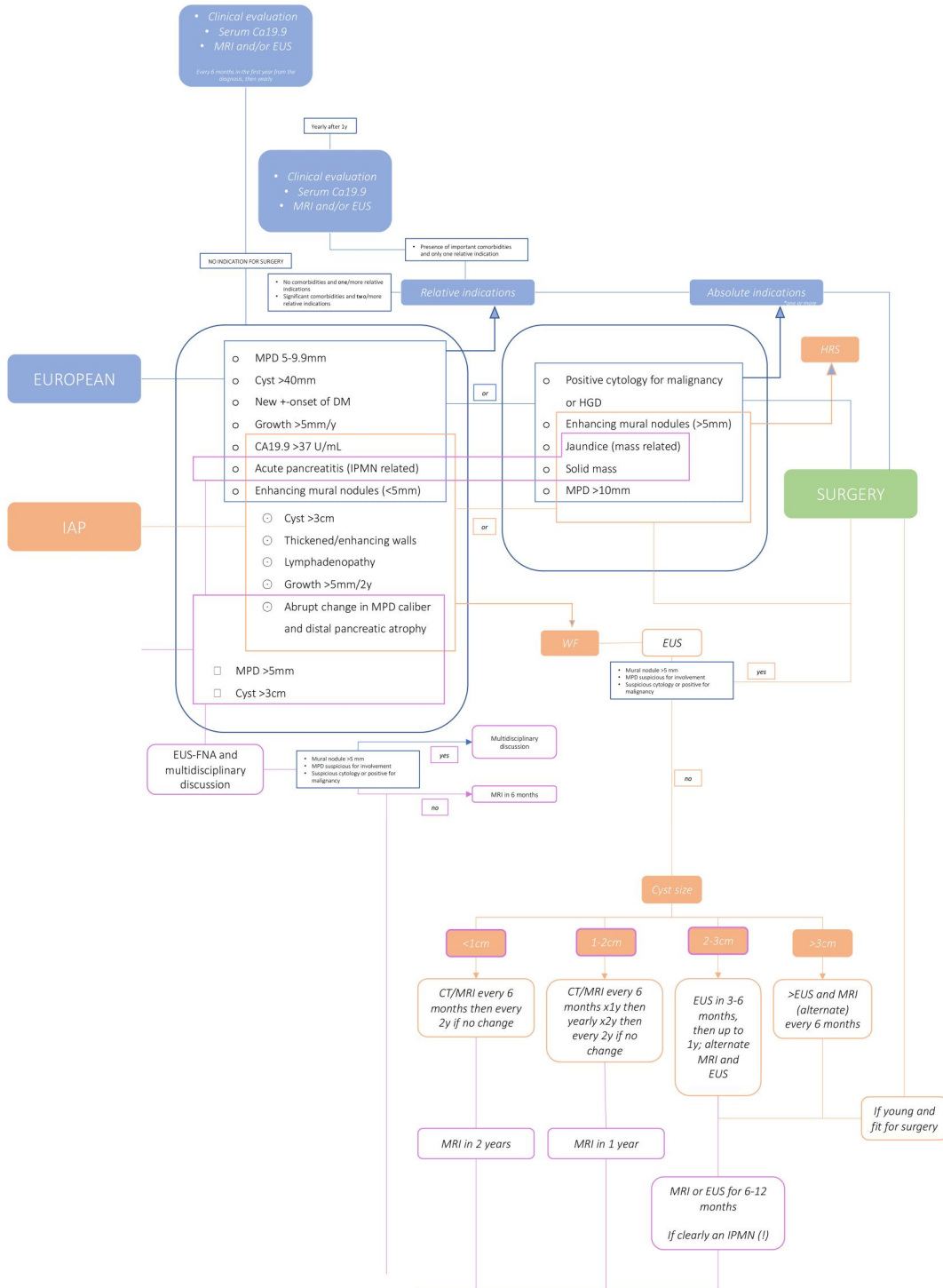


FIGURE 2 iCyst algorithm

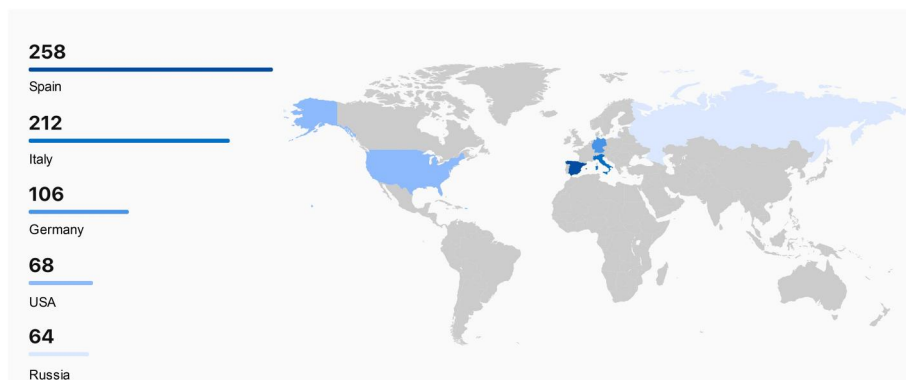


FIGURE 3 iCyst download distribution

TABLE 1 iCyst users and guidelines

	n
Number of users	276
Number of simulations	1020
Chosen guidelines	n. (%)
European	342 (52)
AGA	72 (11)
IAP	143 (21)
None	106 (16)

Abbreviations: AGA, American gastroenterological association; IAP, international association of pancreatology.

were either surgeons (69%) or gastroenterologists (29%). Most of those who declared it were employed in teaching/academic institutions (66%). Overall, 52% of users selected the European guidelines, 21% selected the IAP, and 11% selected the AGA. By contrast, 16% selected the “none” option (Table 1).

Overall case simulation features

Table 2 shows the features of the case simulations. Overall, 59.6% of the simulated cases involved females with a median age of 66 (SD 12.6) years. Most simulated cases were fit for surgery (91.2%) and did not have relevant comorbidities (75.9%).

Representative scenarios

From all 1020 case simulations provided, six representative scenarios were eventually identified to determine possible conflicts between the guideline recommendations and clinical practice:

1. Small asymptomatic presumed branch duct intraductal papillary mucinous neoplasm (BD-IPMN).
2. Asymptomatic presumed BD-IPMN larger than 2 cm.
3. Presumed IPMN with main pancreatic duct (MPD) 5–9.9 mm.

4. Presumed IPMN with worrisome features (WF) in younger patients (<60 years).
5. Presumed IPMN with WF in older patients (>60 years).
6. Presumed IPMN with high-risk stigmata.

Of the 1020 total scenarios, users selected a guideline in 557 cases (55%); in 106 cases (10%), they selected “none” of the guidelines, and they did not respond in 357 cases (35%). After excluding the missing answers and comparing simulations in which the users selected any of the guidelines' recommendations with those in which “none” was selected, the users tended to choose any of the guidelines if the case simulation referred to a patient fit for surgery or without a cyst growth rate >5 mm (Table 3).

LESSONS LEARNED AND FUTURE PERSPECTIVES

We endeavored to investigate which specific guidelines were followed for the management of PCNs through a simulation-based model built in a digital app. Although we found that most users of the iCyst app followed the European Evidence-based Guidelines, some gray areas exist, specifically in situations involving a patient who is deemed unfit for surgery or when a cyst grows rapidly during surveillance. This snapshot study aimed to capture the actual application of guideline policies in “real world” case scenarios.⁶ In the first scenario considering a presumed small BD-IPMN (<1 cm) without specific symptoms, 17.3% of users disagreed with a conservative recommendation and likely supported a more aggressive approach. Since a more aggressive policy in such benign-looking lesions is not supported at all by the available evidence, these data suggest that further guideline dissemination is urgently required to avoid disparities in the treatment of presumably benign PCN.⁷ Likewise, in the presence of a BD-IPMN with a larger diameter (>2 cm) and no associated symptoms, most of the users followed the European guidelines whereas 19% chose none of the guidelines' recommendations. This is again a surrogate metric of a lack of trust in the available policies and the need to increase the evidence in this specific matter. Consequently, not following such conservative policies can

TABLE 2 Overall case simulation features

Representative scenarios	n. (%)
Sex (%)	Male 412 (40.4)
	Female 608 (59.6)
Age, median (standard deviation)	Male 67.5 (11.6)
	Female 66 (12.6)
	Yes (%)
Patient fit for surgery	930 (91.2)
Relevant comorbidities	246 (24.1)
Obstructive jaundice	27 (2.6)
Solid mass	54 (5.3)
Enhancing mural nodule > 5 mm	74 (7.3)
Main pancreatic duct > 10 mm	75 (7.4)
Main pancreatic duct 5–9.9 mm	204 (20)
Enhancing mural nodule < 5 mm	63 (6.2)
Cyst diameter > 30 mm	287 (28.1)
Cyst diameter > 40 mm	128 (12.5)
Grow-rate > 5 mm/y	103 (10.1)
Grow-rate > 5 mm/2 years	138 (13.5)
Thickened/enhancing cystic walls	154 (15.1)
Abrupt change in MPD caliber and distal atrophy	98 (9.6)
Lymphadenopathy	33 (3.2)
New-onset diabetes mellitus (DM)	53 (5.2)
Acute pancreatitis	76 (7.5)
Increased Ca19.9	95 (9.3)
EUS performed	338 (33.1)
Mural nodules at EUS	50 (14.8)
Mural nodule > 5 mm at EUS	25 (7.4)
Main duct involvement/patulous ampulla at EUS	53 (15.7)
Main duct features suspicious for involvement at EUS	73 (21.6)
Cytology (suspicious or positive for malignancy)	15 (4.4)
Size of the largest cyst, median (standard deviation)	1 (1.05)
Small asymptomatic BD-IPMN	111 (10.9)
BIG BD-IPMN with no specific symptoms	100 (9.8)
BD-IPMN with no specific symptoms and MPD <10 MM	47 (4.6)
IPMN with WF in young patients (<60 year)	183 (17.9)
IPMN with WF in old patients (>60 year)	428 (42)
IPMN with HRS	152 (14.9)

Abbreviations: BD-IPMN, branch duct intraductal papillary mucinous neoplasm; EUS, endoscopic ultrasound; HRS, high-risk stigmata; MPD, main pancreatic duct.

be harmful in asymptomatic individuals who can be candidates for long-term follow-up.^{8–10}

Further implementation of guideline awareness is urgently needed as a relevant number of iCyst users did not follow any of the available guidelines on several specific conditions. These findings could serve as the basis for future research lines, in which the level of evidence should be elevated to eventually provide reliable recommendations in future guideline updates.

CONFLICT OF INTEREST

The authors have no conflicts of interest to declare.

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DATA AVAILABILITY STATEMENT

Not applicable.

REFERENCES

- del Chiaro M, Besselink MG, Scholten L, Bruno MJ, Cahen DL, Gress TM, et al. European evidence-based guidelines on pancreatic cystic neoplasms. *Gut*. 2018;67:789–804. <https://doi.org/10.1136/gutjnl-2018-316027>
- Tanaka M, Fernández-del Castillo C, Kamisawa T, Jang JY, Levy P, Ohtsuka T, et al. Revisions of international consensus Fukuoka guidelines for the management of IPMN of the pancreas. *Pancreatology*. 2017;17:738–53. <https://doi.org/10.1016/j.pan.2017.07.007>
- Vege SS, Ziring B, Jain R, Moayyedi P, Adams MA, Dorn SD, et al. American gastroenterological association institute guideline on the diagnosis and management of asymptomatic neoplastic pancreatic cysts. *Gastroenterology*. 2015;148:819–22. <https://doi.org/10.1053/j.gastro.2015.01.015>
- Caravati A, Andrianello S, Pollini T, Biancotto M, Balduzzi A, Malleo G, et al. Branch duct intraductal papillary mucinous neoplasms: recommendations for follow-up and surgery. *Scand J Surg*. 2020;109:34–41. <https://doi.org/10.1177/1457496919900414>
- Chang YR, Park JK, Jang JY, Kwon W, Yoon JH, Kim SW. Incidental pancreatic cystic neoplasms in an asymptomatic healthy population of 21,745 individuals Large-scale, single-center cohort study. *Medicine*. 2016;95:e5535. <https://doi.org/10.1097/MD.0000000000005535>
- Marchegiani G, Salvia R, Stefano A, Alberto B, Tommaso P, Andrea C, et al. Guidelines on pancreatic cystic neoplasms: major inconsistencies with available evidence and clinical practice— results

TABLE 3 Guideline recommendations and clinical practice

	Guidelines	None	p
Number	557	106	0.557
Sex (%)			0.749
Male	230 (41.3)	42 (39.6)	
Female	327 (58.7)	64 (60.4)	
Age, median (standard deviation)	67 (11.7)	65 (13)	-
Patient fit for surgery	519 (93)	93 (87.7)	0.054
Relevant comorbidities	132 (23.7)	24 (22.7)	0.814
Obstructive jaundice	18 (3.2)	3 (2.8)	0.829
Solid mass	28 (5)	5 (4.7)	0.893
Enhancing mural nodule > 5 mm	39 (7)	6 (5.7)	0.615
Main pancreatic duct > 10 mm	37 (6.6)	9 (8.5)	0.493
Main pancreatic duct 5–9.9 mm	112 (20.1)	20 (18.9)	0.770
Enhancing mural nodule < 5 mm	30 (5.4)	3 (2.8)	0.267
Cyst diameter > 30 mm	162 (29.1)	35 (33)	0.417
Cyst diameter > 40 mm	67 (12)	14 (13)	0.734
Grow-rate > 5 mm/y	49 (8.8)	16 (15.1)	0.046
Grow-rate > 5 mm/2 years	70 (12.6)	17 (16)	0.332
Thickened/enhancing cystic walls	84 (15.1)	21 (19.8)	0.221
Abrupt change in MPD caliber and distal atrophy	47 (8.4)	9 (8.5)	0.986
Lymphadenopathy	17 (3.1)	3 (2.8)	0.903
New-onset diabetes mellitus (DM)	31 (5.6)	5 (4.7)	0.724
Acute pancreatitis	37 (6.6)	6 (5.7)	0.707
Increased Ca19.9	51 (9.2)	6 (5.7)	0.239
EUS performed	164 (29.4)	26 (24.5)	0.305
Size of the largest cyst (%)			0.232-
<1 cm	107 (19.2)	20 (18.9)	
1–2 cm	180 (32.3)	25 (23.6)	
2–3 cm	120 (21.5)	30 (28.3)	
>3 cm	131 (23.5)	28 (26.4)	
Missing	19 (3.5)	3 (2.8)	

Abbreviations: EUS, endoscopic ultrasound; MPD, main pancreatic duct.

- from an international survey. *Gastroenterology*. 2021;160:2234–8. <https://doi.org/10.1053/j.gastro.2021.02.026>
- Marchegiani G, Andrianello S, Pollini T, Caravati A, Biancotto M, Secchettin E, et al. “Trivial” cysts redefine the risk of cancer in presumed branch-duct intraductal papillary mucinous neoplasms of the pancreas: a potential target for follow-up discontinuation? *Am J Gastroenterol*. 2019;114:1678–84. <https://doi.org/10.14309/AJG.000000000000378>
 - Marchegiani G, Caravati A, Andrianello S, Pollini T, Bernardi G, Biancotto M, et al. Serous cystic neoplasms of the pancreas management in the real-world still operating on a benign entity. *Ann Surg*. 2020; Publish Ahead of Print. <https://doi.org/10.1097/SLA.0000000000004716>
 - Ohno E, Hirooka Y, Kawashima H, Ishikawa T, Kanamori A, Ishikawa H, et al. Natural history of pancreatic cystic lesions: a multicenter prospective observational study for evaluating the risk of pancreatic cancer. *J Gastroenterol Hepatol*. 2018;33:320–8. <https://doi.org/10.1111/jgh.13967>
 - Han Y, Lee H, Kang JS, Kim JR, Kim HS, Lee JM, et al. Progression of pancreatic branch duct intraductal papillary mucinous neoplasm associates with cyst size. *Gastroenterology*. 2018;154:576–84. <https://doi.org/10.1053/j.gastro.2017.10.013>